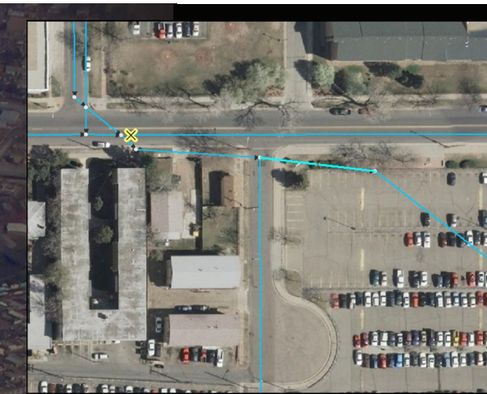
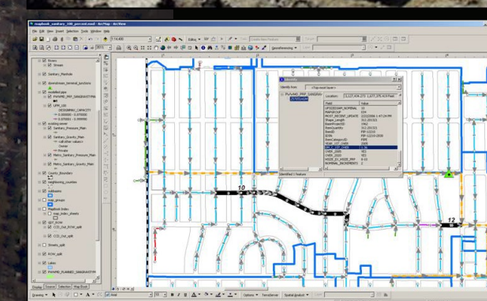
Sanitary Sewer Master Plan

City & County of Denver

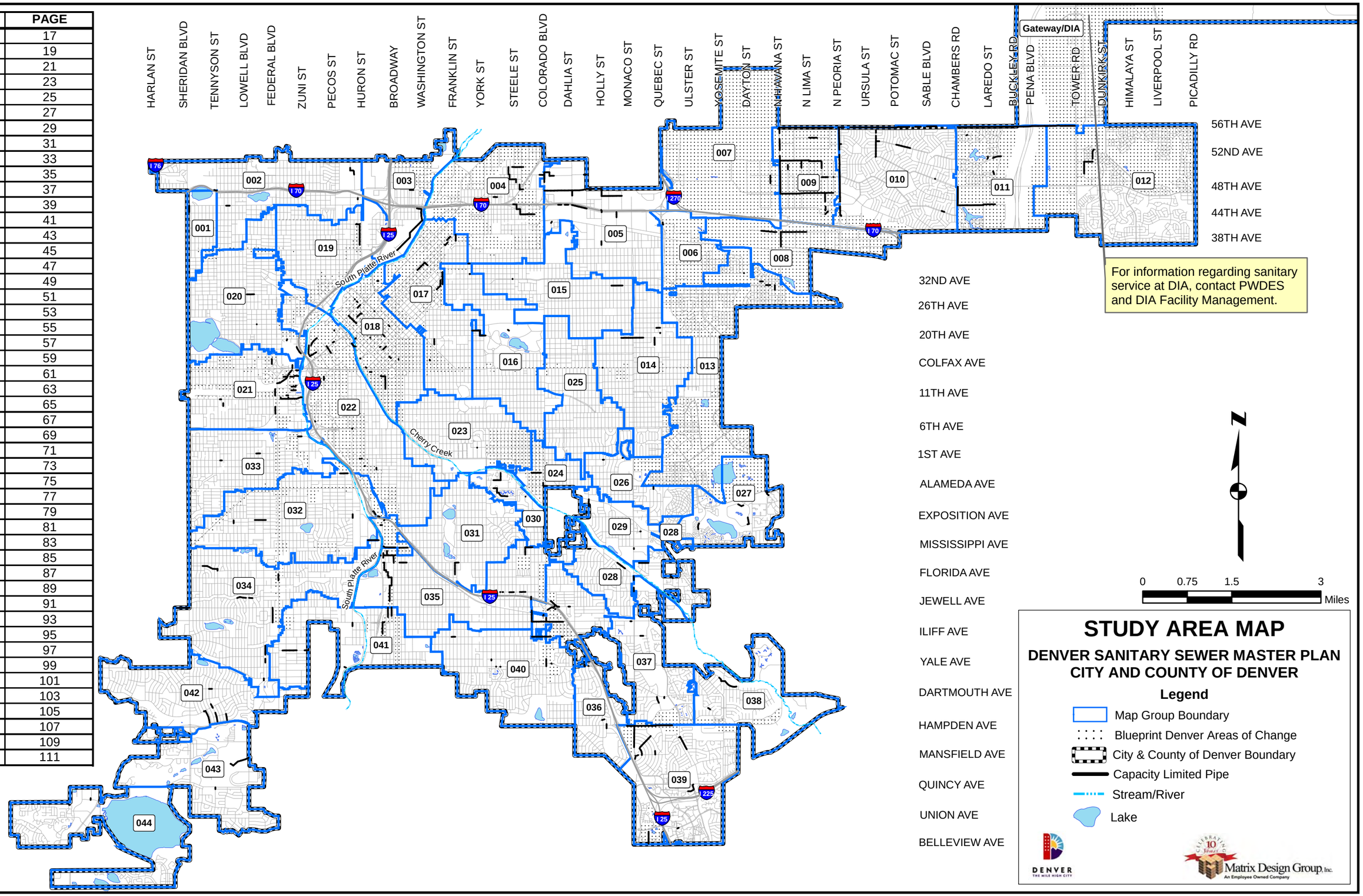
October 2009





Matrix Design Group, Inc.
An Employee Owned Company

MAP SHEET	PAGE
001	17
002	19
003	21
004	23
005	25
006	27
007	29
008	31
009	33
010	35
011	37
012	39
013A	41
013B	43
014	45
015	47
016	49
017	51
018	53
019	55
020	57
021	59
022A	61
022B	63
023	65
024	67
025	69
026	71
027	73
028	75
029	77
030	79
031	81
032	83
033	85
034A	87
034B	89
035	91
036	93
037	95
038	97
039	99
040	101
041	103
042	105
043	107
044	109
Gateway/DIA	111



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Study_Area_Map.mxd, 12/2/2009, chris_martin

TABLE OF CONTENTS

1.0 PROJECT SUMMARY 3

1.1 Project Manager Overview 3
1.2 Executive Summary 3
1.3 Goals of the Sanitary Sewer Master Plan 4
1.4 Objectives of the Sanitary Sewer Master Plan 4

2.0 BACKGROUND 4

2.1 History of Master Planning 4
2.2 Population Forecasting 5

3.0 PROJECT APPROACH 5

3.1 Methodology 5
3.2 GIS Data Quality Control 6
3.3 Land Use Analysis 6
3.4 Hydraulic Loading 7
3.5 Manning's Peaking Factors 9
3.6 Capacity Modeling 9
3.7 Deficiencies Based Upon Current Criteria 9
3.9 Water Quality Considerations 10

4.0 CAPITAL IMPROVEMENTS PROGRAM 11

4.1 Cost Modeling 11
4.2 Summary of Capital Costs 11

ACKNOWLEDGMENT

The project team wishes to acknowledge the various individuals who assisted in the preparation of this update of the Sanitary Sewer Master Plan - 2009 study for the City & County of Denver. A Technical Advisory Committee (TAC), made up of the project sponsors, provided guidance during the study process. The TAC met biweekly for the 2006 Master Plan, and the 2009 updated version, to provide valuable insight and direction to the study. The members of the TAC are:

Brian Schat, Denver Project Manager
Sam Pavone, Denver
Randy Schnicker, Denver
John Gaines, Denver
Mark Gehrke, Denver
Wayne Querry, Denver
Paul Tessar, Denver GIS
Rick Stretz, Denver GIS

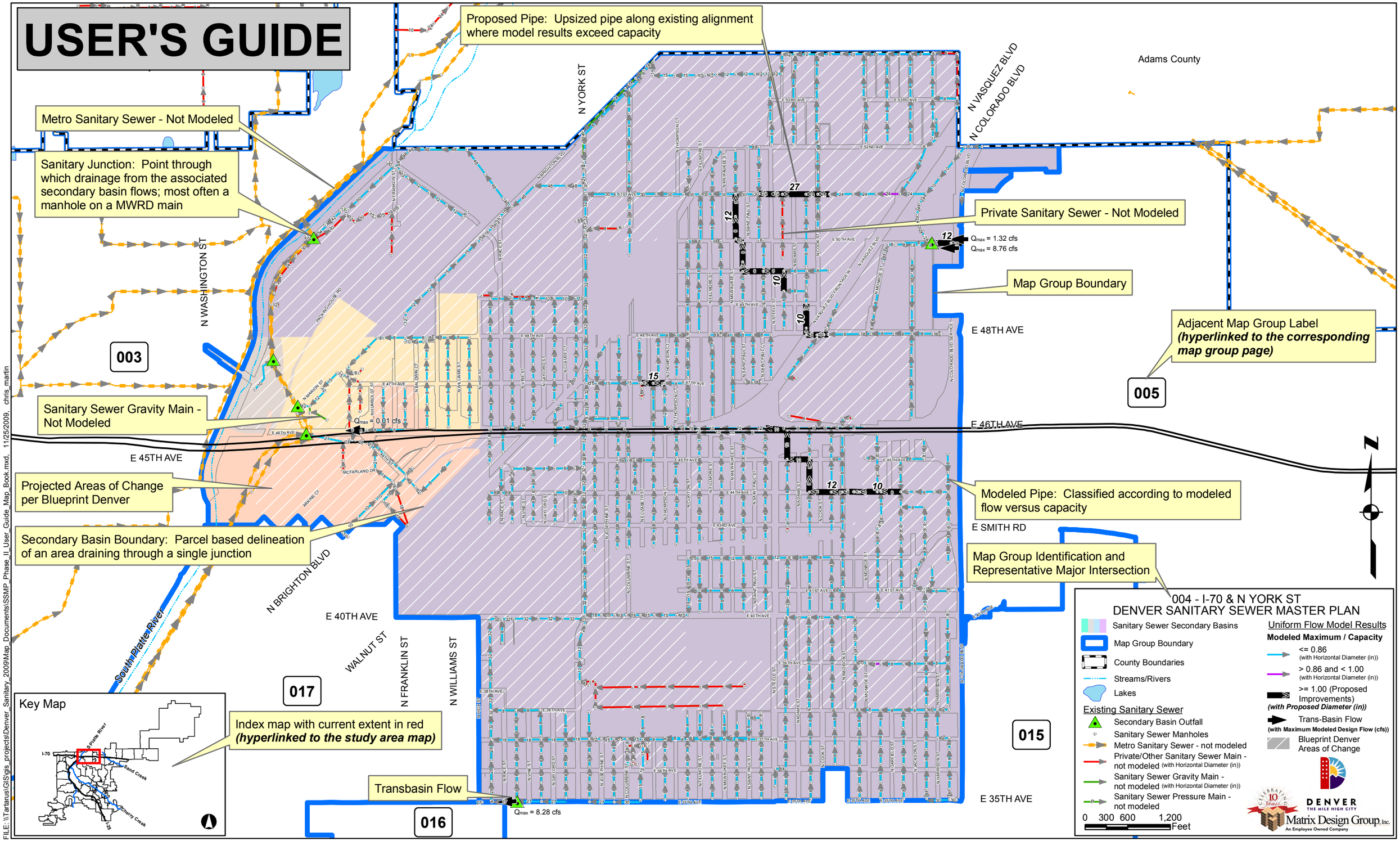
The following members of the consultant project team contributed significant time and effort to the preparation of this Master Plan report:

Matrix Design Group, Inc.:
Robert Krehbiel, Project Manager
Wilson Wheeler, GIS Manager
Chris Martin, GIS Analyst
Ron Ramold, GIS Analyst

Camp, Dresser, McKee, Inc.:
Thomas Charles, Project Manager
Travis Bogan, Project Engineer

Malcolm Pirnie, Inc.:
Cyril Cherian, GIS

USER'S GUIDE


Proposed Pipe: Upsized pipe along existing alignment where model results exceed capacity
Metro Sanitary Sewer - Not Modeled
Sanitary Junction: Point through which drainage from the associated secondary basin flows; most often a manhole on a MWRD main
Private Sanitary Sewer - Not Modeled
Map Group Boundary
Adjacent Map Group Label
(hyperlinked to the corresponding map group page)
Sanitary Sewer Gravity Main - Not Modeled
Projected Areas of Change per Blueprint Denver
Secondary Basin Boundary: Parcel based delineation of an area draining through a single junction
Modeled Pipe: Classified according to modeled flow versus capacity
Map Group Identification and Representative Major Intersection
Index map with current extent in red
(hyperlinked to the study area map)
Transbasin Flow
Key Map
Adams County
N YORK ST
N VASQUEZ BLVD
N COLORADO BLVD
N WASHINGTON ST
E 48TH AVE
E 46TH AVE
E 45TH AVE
E SMITH RD
N BRIGHTON BLVD
E 40TH AVE
WALNUT ST
N FRANKLIN ST
N WILLIAMS ST
E 35TH AVE
South Platte River
003
005
015
016
017
Qmax = 1.32 cfs
Qmax = 8.76 cfs
Qmax = 0.01 cfs
Qmax = 8.28 cfs
004 - I-70 & N YORK ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_User_Guide_Map_Book.mxd, 11/25/2009, chris_martin

1.0 PROJECT SUMMARY

1.1 Project Manager Overview

This update of the Sanitary Sewer Master Plan - 2009 indicates that the sanitary system's current capacity meets most of the needs of development and redevelopment in Denver. This update shows fewer pipes to monitor for limited capacity. Approximately 3% of the pipe network needs to be monitored for capacity issues, down from 9% in the 2006 Plan. The cost estimate to replace identified pipes was reduced to roughly $72 million, down from $182 million in the 2006 Plan. The results of the Capacity Model are available, in paper and GIS format, for staff reference to support both land development review and maintenance operations.

Three significant updates were made to improve on the 2006 Sanitary Sewer Master Plan:

1. The *Sanitary Sewer Design Technical Manual* was updated in March of 2008. The formula used to calculate the flow in a pipe has been reduced based on over 20 years of pipe metering data. John Gaines, of Denver Wastewater Management Division, reviewed the historic record of sanitary flow metering and recalculated the peaking factor for the flow formula. Land use loading factors have also been revised to more closely match the 2000 Census data for residential household size and water consumption information from billing records in 2000. The new criterion was used in this Master Plan.

2. The Capacity Model was reprogrammed to run in Environmental Systems Research Institute's (ESRI) ArcGIS Geographic Information System (GIS) program. In 2006, it took staff three weeks to run the Model, in two programs, requiring import and export of data. The lessons learned in the first modeling effort were used to program the GIS based Model to run in less than an hour for the study area. GIS tools were developed to evaluate development impacts on a planning level review. These tools also allow for long term updates to land use and the sanitary network to provide concept level calculations for improvements.

3. The sanitary network was updated to support many new requirements of the Capacity Model. The support and improvement of the data has been an integral part of the modeling process. Data improvement has made it possible to update this Master Plan and will lend value to future efforts. Paul Tessar, Rick Stretz, and Dan Houser, of Denver GIS, supported the data improvement for the Master Plan.

This planning effort reiterates the need to focus on the condition of our sanitary network. The documentation of the current television inspection program, and on-going maintenance efforts, will prove valuable in ranking the system condition.

The Wastewater Management Division staff has provided a plan to meet future sanitary system service needs for over a century. Sanitary system capacity still will need to be monitored and managed based on the development changes that take place in the future. This Master Plan provides the way to continue monitoring capacity needs.

This project was a team effort, accomplishing much with the experience and vision of all. My thanks go out to the staff that helped to accomplish this Master Plan. Our next focus will be to review and assess wastewater collection system condition.

Brian Schat, P.E.
Project Manager

1.2 Executive Summary

The City & County of Denver currently operates and maintains just under 7.8 million lineal feet of active, existing public sanitary sewer system within their jurisdiction. This does not include the roughly 875,000 feet of pipe owned and maintained by the Metro Wastewater Reclamation District (Metro), or the roughly 1.3 million feet of privately owned and maintained pipe within the City. This Sanitary Sewer Master Plan serves as the framework for management of sanitary sewer capital improvements within the City & County of Denver. The Master Plan has been prepared to provide new information, available via GIS, about the adequacy of the City's sanitary sewer infrastructure to accommodate future growth based upon land use. This update process includes the 155 square miles of the City & County of Denver, with special focus on areas experiencing major redevelopment. This Master Plan provides an overview evaluation of loading and hydraulic conditions, and identifies areas of possible deficiency and associated capital improvements that may be needed within the City.

The sanitary sewer collector system has increasingly become a critical infrastructure element for capital improvement planning as growth and major redevelopment occurs across the City. The completion of the Denver Land Use and Transportation study resulted in the formulation of *Blueprint Denver: An Integrated Land Use and Transportation Plan*, which ostensibly prepares the City for continued urbanization and redevelopment. One of the major goals of this updated plan is the integration of master plan documents and programs into a comprehensive Public Works Management Program.

This Master Plan looks ahead to year 2050 at growth areas and areas with significant changes in land use densities to determine that 201,074 lineal feet of the City's sanitary sewer system may be capacity limited in the foreseeable future. This will result in ongoing monitoring for approximately 2.6% of the existing City owned and maintained sanitary sewer lines for capacity related issues. Further study and monitoring of these capacity limited reaches will be necessary to determine actual infrastructure needs.

A total of approximately $72 million in capital improvements has been identified for sanitary sewer upsizing based upon capacity constraints for the projected *Blueprint Denver* land use. This cost projection equates to an average of $358 per lineal foot total cost for upsizing existing sanitary sewer systems. This includes manholes, pavement patching, incidentals, administrative, and contingency costs.

The next step, beyond this Master Plan, will be continued system monitoring by metering and prioritizing improvements to address capacity deficiencies. Pipe condition will be documented by television inspection and will be included in the prioritization process.

1.3 Goals of the Sanitary Sewer Master Plan

To provide direction to the planning process and capitalize on the extensive experience and knowledge of staff, selected members of the City Public Works and Planning Departments were interviewed. The following questions were posed to these stakeholders:

What are the Primary Sanitary Sewer Issues Confronting the City?

- As the City is developed to the allowable land use, some of the sanitary sewer system will not meet current criteria, whereby the pipes are flowing no more than 80% depth (approximately 86% of the sewer's full flow capacity) in a peak event. In other words, pipes are sized in the Master Plan to provide for theoretical capacity for flows based upon maximum probable land use zoning.
- The existing sanitary infrastructure is aging and maintenance is required. Some segments are over 100 years old. It is necessary to replace or rehabilitate many reaches of pipe each year to reduce infiltration and inflow and improve the integrity of the pipe.
- The Master Plan needs to address the implications of redevelopment. Major projects, such as Stapleton and Lowry, benefited from scale economics and private-sector developer investments to construct new collectors and outfalls. Smaller redevelopment projects, such as those within Lower Downtown, may lack the financing and cohesion to build completely new systems.

What Approach Should be Followed to Provide an Upgraded Sanitary Sewer System?

- Ensure compatibility with *Blueprint Denver*
- Ensure compatibility with current land uses and needs
- Support, and be compatible with, the current Capital Improvement Program for sanitary and other Public Works programs like the Environmental Management System and Greenprint Denver
- Encourage and enable development participation
- Provide phasing and priorities for capital improvements
- Minimize construction impacts to already developed properties
- Provide a document that is rational and likely to foster support for capital improvements
- Minimize Costs

What are the Goals for the Master Plan Update Process?

- Provide a framework document that informs staff of potential deficiencies
- Create optimal value with the Master Plan to capitalize on available revenues, while providing the greatest level of service
- Ensure that facilities are designed as required by criteria, and that a commensurate budget for new capital improvements is anticipated and budgeted
- Provide a "toolbox" for reviewing development proposals, including access to background information used in the plan and models that may be modified by staff as more specific development proposals are submitted
- Provide a framework for continued urbanization of the City & County of Denver and implement the concepts and tenets of *Blueprint Denver*

What Challenges Would Prevent Denver From Obtaining This Goal?

- Modeling should be developed in sufficient detail to support the conceptual design and sizing of infrastructure. The Master Plan proposed improvements will be used to identify possible deficiencies and establish budgets for capital improvements. The current alignment of the system will be used to calculate the additional capacity needed in future build-out conditions. This concept level calculation will be used to estimate cost of improvements for deficient pipes.

What is an Appropriate Measure of Success for the Update Process?

- Completion of the Master Plan with enough detail to validate or justify modification of the City's current Capital Improvement Program
- Establishment of a framework for screening options and supporting a preferred plan for implementation
- Creation of a document that is usable and provides for continued update by the City

1.4 Objectives of the Sanitary Sewer Master Plan

The Master Plan helps to determine wastewater collection system needs and guide capital improvements through 2050. It is a "living document" that undergoes modification utilizing the City's GIS data and modeling methods to update planning information, collection system configuration, and the Capital Improvement Program. The Master Plan GIS Tools allow the City staff to analyze "what-if" scenarios to predict sanitary sewer system impacts from changes in land use, timing of development, wastewater flow criteria, and other factors.

2.0 BACKGROUND

2.1 History of Master Planning

According to Denver's 1950 Sanitary Sewer Master Plan, Denver has provided sanitary system improvements for over 100 years. It states, "The first public agitation for improved sanitary facilities came between 1870 and 1880 when large population increases produced acute sanitary problems". The 1917 annual report of the Department of Improvements and Parks contains the following account:

> *December 9, 1875, a committee, after considerable agitation in the City, reported a sewage system as impractical for the City.*
>
> *There was a little agitation now and then until May 2, 1878, when a committee reported adversely on sewerage, but recommended individual drain pipes, adding that if the people wanted to vote bonds for a system they would be allowed to do so. It was urged that the system would cost $37,000, and the City had no money.*
>
> *December 5, 1878, sewer agitation continuing, a committee that had been sent to St. Louis reported on a sewage system with 24-inch pipe in Wazee Street and 15-inch pipe in Fifteenth, Seventeenth, and Nineteenth Streets from Curtis to Wazee, to cost $28,000 that would drain that portion of the City for all future time.*

In 1879 the agitation continued and a sewer district embraced by Delgany Street, Broadway, West Colfax, and Twentieth Street was urged, but again it was declared the city had no money, and the people were adverse to voting bonds. In 1880, the agitation continued, and in 1881 the first sanitary sewer was built, being 4,620 feet in length and costing $24,192.16.

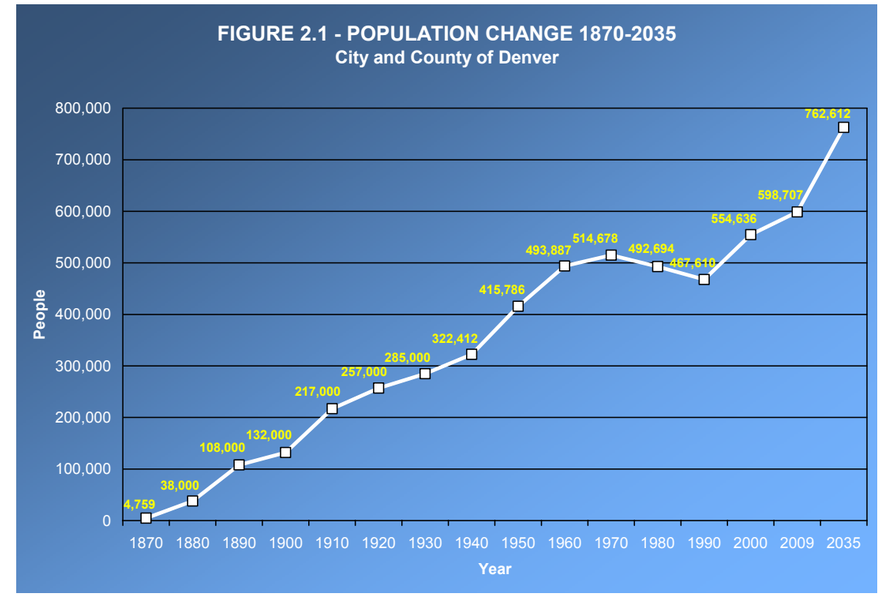
The 1950 Master Plan goes on to state, "From this meager beginning 70 years ago, the sanitary sewer system has grown to the present extensive network. The rate of growth has varied with the times. During years of war or depression few, if any, new sewers were constructed. On the other hand, during periods of prosperity it has sometimes been difficult to expand the system rapidly enough to keep pace with the growth of the City." In 1950, there were over 800 miles of lateral and main sanitary sewers contributing flow to two sewage treatment plants. The 2008 GIS figures indicate just under 1,900 miles of sanitary sewers in the City & County of Denver, and the flow is treated at the Metro District's Robert W. Hite Metro Treatment Facility in northeast Denver.

The 1950 Master Plan showed vision and foresight for sanitary master planning. According to the Master Plan, "The sanitary sewer system was under the direct supervision of the late Mr. Charles A. Davis, City Sanitary Engineer, from 1913 to 1951. Much of the present system and both treatment plants were constructed during this period. From the facts presented in the remaining part of the report, it will be apparent that the policies followed in the design and construction of sanitary sewers have been sound and farsighted. The citizens of Denver should be proud of their sanitary sewer system and of the men responsible for its development."

Master planning efforts in the 1970's and 1980's identified system needs that were improved by capital projects. The 2009 Master Plan serves as an update to the first GIS based Master Plan completed in 2006.

2.2 Population Forecasting

When the 1950 Master Plan was completed, the population of Denver was 415,786. At the time, this was a major increase of 29 percent over 1940 and was the largest percentage increase for any 10 year period since 1910, which prompted the need for infrastructure master planning to serve the growing population. The 1950 Master Plan anticipated a population in 1970 of 560,000 (actual was 514,678). Figure 2.1 summarizes data provided by the Denver Office of Information Technology, and depicts the population of Denver by 10 year increments from 1870 through 2000. The July 2009 population estimate, according to the *Denver Business Journal*, is 598,707. Although mostly built-out, the population is expected to continue to increase with higher development densities. By the year 2035, the Denver Regional Council of Governments forecasts a population of 762,612. Figure 2.1 illustrates this change in population from 1870 to 2035.

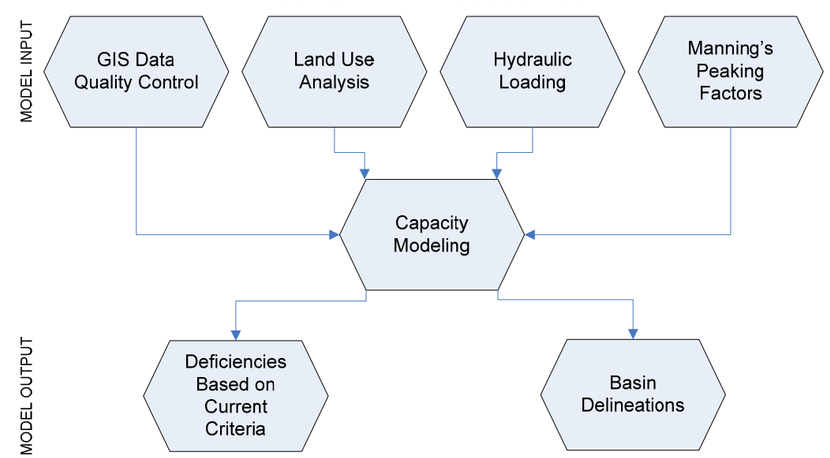


3.0 PROJECT APPROACH

3.1 Methodology

Figure 3.1 illustrates the process flow followed to complete the modeling portion of this Master Plan.

FIGURE 3.1 – PROCESS FLOW



GIS data for the sanitary sewer network and land use were evaluated for inaccuracies. The land use data were processed for current and future loading to the sanitary system on the parcel level. Each parcel's flow was assigned to a sanitary pipe. A Capacity Model accumulated the flow from each parcel downstream in the sanitary network. The flow was peaked and took into account infiltration and inflow. Pipe flows were compared against pipe capacities for possible capacity deficiencies. Capacity deficient pipes were assigned a cost for improvement based on historical bid data.
Basins were delineated based on logical groupings of pipe.

3.2 GIS Data Quality Control

The City's comprehensive GIS database was used heavily in this Master Plan study to evaluate land use and existing pipe networks. The data were reviewed and corrected based on the best available information and staff knowledge. Special data management tools were developed that assisted Master Plan users in viewing and modifying GIS data. Capacity Model data input and output were incorporated into the GIS database to determine capacity limitations of the existing system and to propose sanitary infrastructure improvements.

3.3 Land Use Analysis

Blueprint Denver is an essential framework document that establishes the basis for future land use planning, advocating that land use and transportation decisions be made in conjunction. To assist with future planning, Areas of Change and Areas of Stability are delineated in *Blueprint Denver*. Areas of Change depict expected development areas based on a 2050 build-out condition. The Areas of Change data are included with the Master Plan mapping, for reference, to show the potential changing land use, and to highlight the areas where capital investment in infrastructure may be needed.

Denver's *Sanitary Sewer Design Technical Manual* underwent a revision in March of 2008 to update policies, methods, practices, procedures, and design standards utilized in the Department of Public Works' activities. The intended purpose of the document is to provide guidelines for the design of sanitary sewers, thereby encouraging consistency. Loading factors have been updated to the 2008 criteria. These better suit the average metered flows observed in each zone district based on population density analysis. 2020 land use categories were then matched to their zone district counterpart to determine their flow factors.

The City's GIS parcel and *Blueprint Denver* concept land use data were used to establish sanitary sewer loading. The Capacity Model can incorporate updates to land plans and growth rates, including the incorporation of future GIS data and graphical user interfaces.

Loading factors are based on the property's land use/zoning. System capacity loading was computed by linking land use with loading factors as shown in Table 3.1. For this study, two primary land use scenarios have been utilized: Year 2009 and Year 2020 from *Blueprint Denver*. The Capacity Model applies the appropriate loading factors to the land uses.

In this 2009 update to the Master Plan, demographic information was used to test existing and future land use assumptions. Population and employment data were obtained from the Denver Regional Council of Governments for the years 2005, 2015, and 2030. Areas of the City were divided into Traffic Analysis Zones. Analyses were completed, on the subbasin level, to compare predicted sanitary flow from the demographic data to the predicted flow for the land use data. A future, more refined, study will need to be conducted to thoroughly validate the land use assumptions against the demographic information.

Hydraulic modeling was completed to compare existing hydraulic capacity with anticipated future flows. Flow projections for the Master Plan are based on the current zoned land use designation and *Blueprint Denver*, modified, as necessary, to better reflect the anticipated development of any particular parcel. The overall planning criteria for the City & County of Denver is to attempt to provide sewerage capacity to accommodate the current zoned land use or future predicted land use, not necessarily the actual existing land use. Therefore, Model data showing sanitary sewer lines unable to convey future flows may be functioning well within capacity today. However, if the entire tributary basin were built to zoned land use, there likely may be capacity deficiencies. The next step, beyond the Master Plan, is to field verify capacity-limited reaches by monitoring flows in the pipe before programming and designing improvements.

Flow projections, using these planning criteria, likely result in flows that are different from the flows currently conveyed in the existing system. Parcels may not currently be built to their full land use densities. Therefore, the flows projected in this Master Plan may not be appropriate for final design. If the difference in flows between the current land use and zoned/future land use is significant, replacing an existing pipeline, with a significantly larger diameter pipeline, could result in low depths that may contribute to depositional problems as well as possible hydrogen sulfide issues, including odor and corrosion.

TABLE 3.1
SANITARY SEWER LOADING TABLE BY LAND USE

2008 Land Use Zoning	Level of Density	Criteria Manual Description	Detailed Description	Loading Factor (Gallons / Day / ~~Gross~~ Acre)
B2	Low	Neighborhood business	Neighborhood business zone district	3,000
B3	Low	Shopping center	Shopping center zone district	3,000
BA3	Low	Arterial general business	Arterial general commercial district	3,000
Neighborhood Center	Low	Light industrial	49% B2 - 10% B3 (use I0)	3,000
Pedestrian Shopping District	Low	Neighborhood business	23% B4 - 13% B2 - 14% R3 - 11% R4 (use B2)	3,000
Regional Center	Low	Shopping center	40% B4 - 33% B2 (use B3)	3,000
B1	Medium	Limited office	Office space including medically related services, often for the short-term needs of nearby residential areas	5,000
B4	Medium	General business	General business zone district	5,000
BA1	Medium	Arterial office and multi-unit dwellings	Arterial office and institutional use district	5,000
BA2	Medium	Arterial service	Arterial service district	5,000
BA4	Medium	Auto sales and service	Auto sales and service district	5,000
Employment	Medium	Arterial office and multi-unit dwellings	39% C(MU)30 - 21% C(MU)20 - 16% I2 (use BA1)	5,000
H1A	Medium	Hospital	Healthcare facility	5,000
MS1	Medium	Main street - 1	Main street 1 applies to sections of main streets in close proximity to medium density residential areas characterized by residential structures of one to two stories	5,000
Town Center	Medium	General business	21% C(MU)20 - 17% B3 - 17% OS1 - 13% B4 (use B4)	5,000
B7	High	Historic business	Business restoration zone	8,000
B8	High	Intensive general business / high density residential	Intense general business/very high density residential zone district primarily for activity centers	8,000
B8A	High	Arapahoe Square zone district	Arapahoe Square zone district	8,000
B8G	High	Golden Triangle zone district	Golden Triangle zone district	8,000
H1B	High	Hospital	Healthcare facility	8,000
H2	High	Hospital	Healthcare facility	8,000
B5	Very High	Central business district	Central business district	66,000
Downtown	Very High	Central business district	55% B-5 - 44% B7 (use B5)	66,000
I0	Low	Light industrial	Light industrial	3,000
I1	Low	General industrial	General industrial	3,000
I2	Low	Heavy industrial	Heavy industrial	3,000
Industrial	Low	Light industrial	54% I2 - 27% I1 - 12% I0 (use I0)	3,000
CCN	Low	Cherry Creek North	Cherry Creek North district	3,000
Entertainment Cultural Exhibit	Low	Arterial general business	37% 'blank' - 35% I1 - 15% PRV - 10% B8G (use BA3)	3,000
R3X	Medium	Multi-unit dwellings, medium density	Medium density/multiple unit dwelling zone district (new residential development in older developed areas)	3,000
Campus	Medium	Arterial service	16% O1 - 16% R1 - 14% R3 - 11% R5 - 11% PRV - 11% B1 (use BA2)	5,000
Commercial Corridor	Medium	Limited office	41% B4 - 13% B2 - 11% B3 (use B1)	5,000
R5	Medium	Institutional	Institutional zone district where colleges, schools, governmental offices for the administration of churches, religious or charitable organizations, and other institutional uses are permitted	5,000
PUD	Low	N/A	Planned unit development (combination of land uses)	5,500
R3	High	Multi-unit dwellings, high density	High density/multiple unit zone district. Accessory uses generally include neighborhood services in developments over a specific size.	6,000
R4	High	Multi-unit dwellings and/or offices, high density	High density residential and office zone district. Hotels and motels are permitted. Conditional uses include: neighborhood services, nursing homes, and parking	6,000
R4X	High	Multi-unit dwellings and/or offices, high density	High density residential and office zone district with design guidelines. Hotels and motels are permitted. Conditional uses include: neighborhood services, nursing homes, and parking	6,000
RMU20	High	Residential mixed use	Residential mixed use district allowing either single or multiple unit dwellings. Along collector or arterial streets, development may be either residential or mixed use, combining residential with neighborhood-serving retail	6,000

TABLE 3.1
SANITARY SEWER LOADING TABLE BY LAND USE

2008 Land Use Zoning	Level of Density	Criteria Manual Description	Detailed Description	Loading Factor (Gallons / Day / ~~Gross~~ Acre)
Urban Residential	High	Multi-unit dwellings, high density	63% R3 (use R3)	6,000
CMU10	High	Commercial mixed use	Commercial mixed use district (high-visibility locations)	8,000
Mixed Use	High	Historic business	26% CMU30 - 19% B3 - 14% CMU20 (use B7)	8,000
MS2	High	Main street - 2	Main street 2 applies to sections of main streets in close proximity to high density residential areas characterized by residential or mixed use structures of two or more stories	8,000
MS3	High	Main street - 3	Main street 3 applies to sections of main streets in close proximity to enhanced transit corridors or downtown	8,000
PRV	High	Platte River Valley district	Platte River Valley zone district	8,000
R30	Very High	aka RMU30	aka RMU30	24,000
RMU30	Very High	Residential mixed use	Residential mixed use district allowing higher density multiple unit dwellings of a density appropriate to the city center and other activity centers	24,000
C20	Med High	aka CMU20	aka CMU20	30,000
CMU20	Med High	Commercial mixed use	Commercial mixed use district (commercial, residential, and industrial uses along or near arterials or other high traffic streets)	30,000
C30	Very High	aka CMU30	aka CMU30	66,000
CMU30	Very High	N/A	Commercial mixed use district (wide range of commercial, office, retail, industrial, and residential uses that allow property owners the flexibility to respond to the long-term evolution of development trends)	66,000
TMU30	Very High	Transit mixed use	Transit mixed use district with urban development proximate to a mass transit railway system station to promote a mix, arrangement, and intensity of uses that support transit ridership and use of other transportation modes, especially walking	66,000
Transit Oriented Development	Very High	Transit mixed use	22% I1 - 18% B2 - 16% B1 - 11% B4 (use TMU30)	66,000
Rights-of-Way	N/A	N/A	N/A	0
Water Body		N/A	N/A	0
Golf Course	N/A	Open space	Use O1	50
O1	N/A	Open space	Open space district	50
O2	N/A	Open space / agricultural	Open space district	50
Open Space Limited	N/A	Open space / agricultural	Open space/agriculture (O2)	50
OS1	N/A	Open space	Open Space District (publicly and privately owned parks, open space, natural habitats, golf courses, and a limited range of other uses, such as public or private recreation centers and concessions, that may enhance the use and enjoyment of open space)	50
P1	N/A	N/A	Off-street parking	50
Park	N/A	Open space	Use OS1	50
RS4	Low	Single-Unit detached dwellings, suburban density	Suburban density detached single unit dwelling zone district	1,000
RX	Medium	Attached or clustered single-unit dwellings, low density	Residential district which requires approval of a development plan by city council	1,500
R0	High	Single-unit detached dwellings, low density	High density/detached single unit dwelling zone district	2,000
R1	High	Single-unit detached dwellings, low density	High density/detached single unit dwelling zone district	2,000
R2	Low	Multi-unit dwellings, low density	Low density/multiple unit dwelling zone district, typically duplexes and triplexes	2,000
Single Family Residential	High	Single-unit detached dwellings, low density	58% R1 (use R0)	2,000
R2A	Medium	Multi-unit dwellings, medium density	Medium density/multiple unit dwelling zone district with specific limited accessory uses in developments with at least 300 units	3,000
R2B	Medium	Multi-unit dwellings, medium density	Single and multiple unit dwelling zone (duplexes, row houses, and some single family residences. No accessory uses are allowed)	3,000
Single Family Duplex	Medium	Multi-unit dwellings, medium density	29% R2 - 22% R2A - 19% R3 (use R2A)	3,000

3.4 Hydraulic Loading

Flow from all parcels was loaded to pipes based on proximity and knowledge of how the flow connects into the system. Spider lines were used to graphically represent the connection of a parcel to a pipe. Spider lines, in red, are illustrated in Figure 3.2.

FIGURE 3.2 - SPIDER LINES

3.5 Manning's Peaking Factors

To determine the adequacy of the sanitary sewer pipes to convey the flow, a peaking factor is generally applied per the *Sanitary Sewer Design Technical Manual*. The peaking factors are based upon average daily flow rates. As the sanitary basins become larger, the peaking factor decreases. During the 2006 effort, the equation used was: peaking factor = 3.8 x $(ADF)^{-0.17}$; where ADF is the Average Daily Flow in cubic feet per second with the peaking factor capped at 5.0. The 2009 effort caps the peaking factor at 4.0 and uses the equation: peaking factor = 2.6 x $(ADF)^{-0.16}$. The Denver Wastewater Metering Program records, for over 20 years, were used to determine the change in the peaking factor equation. This study was the basis for changing the design criteria.

3.6 Capacity Modeling

The Capacity Model approach was used throughout the City to simulate the operation of the City owned and maintained sanitary sewer collection system for the sanitary basins under current (2009) and future (2015, 2020, 2030 and 2050) scenarios. The Model is based on the assumption that flow is steady through time. The goal is to predict the maximum flow that could be possible and plan to meet those conditions. The system's ability to convey wastewater loads under dry and wet situations was analyzed. Maximum flow is determined by multiplying the average sewer flow by a peaking factor and adding infiltration and inflow. This Master Plan used a constant infiltration and inflow rate of 500 gallons per acre per day for sanitary sewer design. The Model accumulates the flow downstream through the sanitary sewer pipe network. Reaches of pipes that were at, or near theoretical capacity, were identified for improvements in this Master Plan. Upsizing of capacity limited pipes was based on Manning's Equation, which takes into account pipe diameter, slope, and a friction factor. Manning's Equation relates pipe flow as a function of pipe slope and diameter.

3.7 Deficiencies Based Upon Current Criteria

The Model output was symbolized to identify, by color coding, all pipe sections with surcharging or d/D (design hydraulic depth to pipe diameter ratio) values at specified levels. This color coding allowed City staff to identify sections that are nearing or at critical threshold levels. This Master Plan document utilized the model results to indicate system capacity deficiencies shown herein on basin/subbasin maps.

Pipes in blue will theoretically be operating, based upon allowable land use, at 86% or less hydraulic capacity. Pipes shown in purple will theoretically be operating above 86% but less than 100% of hydraulic capacity. Although this may be beyond the criteria of 80% of full flow depth for new pipe, this shows that the existing system should be capable of handling build-out flows. These pipes may need to be monitored in the future. Pipes shown in heavy black will theoretically be operating at or over 100% hydraulic capacity. These pipes could be identified as capital improvements based upon exceedence of hydraulic capacity. Figure 3.3 depicts a cross section of pipe with these three categorized levels of flow. Figure 3.4 illustrates a typical pipe reach under study for upgrade.

FIGURE 3.3 – PIPE FLOW CROSS SECTION

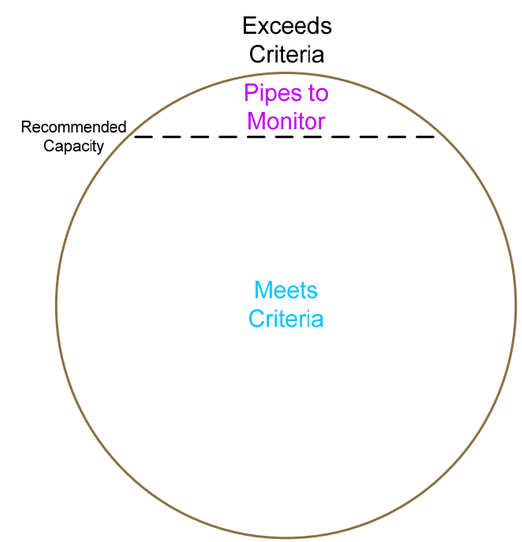
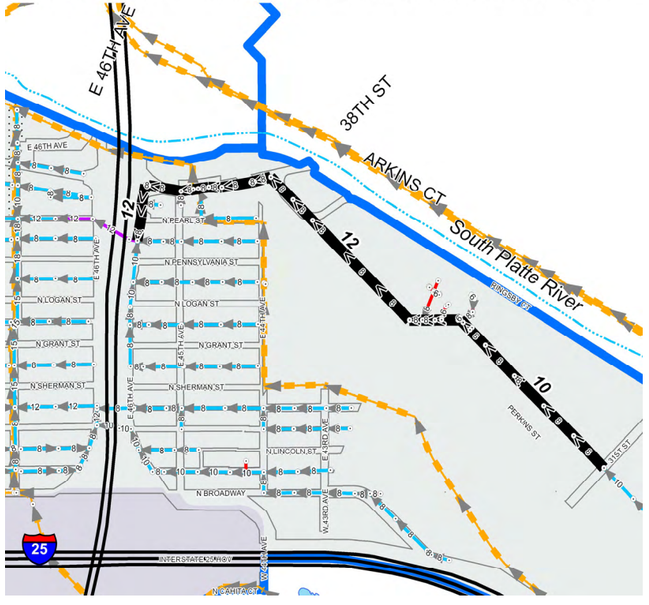


FIGURE 3.4 - TYPICAL PIPE REACH UNDER STUDY



The "Proposed Improvements" designation identifies the diameter, in inches, in bold, black numbers along the pipe reach. The pipe's capacity shall be such that the sewer is flowing at no more than 80% of the full depth at the calculated peak flow rate. A depth-variable friction factor shall be used such that the partial flow rate at 80% depth is approximately 86% of the sewer's full-flow capacity. The peak sewage flow rate shall be equal to the summation of commercial, industrial, and residential average flows multiplied by an appropriate peaking factor plus an infiltration and inflow (I&I) allowance.

Required sewer capacity = ((peaking factor x average sewage flow) + I&I) /0.86.

The proposed capital improvements are shown as complete replacement with a circular pipe having conveyance capacity for the appropriate level of service based upon potential land use. Conflicting utilities, and other constraints, may necessitate infrastructure equivalents such as parallel pipes. Capital improvements are based upon the slope of the new pipe matching the slope of the existing pipe. Shallower slopes, determined during preliminary design, may necessitate larger pipes.

This Master Plan shows the proposed capital improvements as a basis for evaluating sanitary sewer upgrades by recommending removal of the existing pipe and replacement with the larger new pipe. Further study will be required to determine specific project scope. Additional study (beyond the scope of this Master Plan) will evaluate the condition of the existing pipe, calibrate the theoretical flows with meter flow data, and potentially propose alternative capital improvement projects. Such alternatives include constructing a parallel pipe, slip-lining the existing pipe, proposing a new pipe alignment, or accepting existing conditions where flows can be accommodated in a full flow pipe.

3.8 Basin Delineations

Basins for the Denver sanitary sewer system were defined, by the existing pipe network, from the point where they outfall to the Metro sewers. Outfall points to Metro sewers were identified and subbasins were defined as sanitary sewers tributary to a single Metro interceptor. This was a starting point for basin delineations which were refined for manageable areas of study, referred to as "Map Groups", for purposes of this Master Plan. Subbasins have been grouped and displayed for map presentation at a 1" = 1,200 foot scale in an 11x17 format. Each map includes general planimetric features, street names, rights-of-way, existing sanitary sewers with a size designation, pipe material and direction of flow, legend, and key map.

The Central Business District, of downtown Denver, was the initial focus of the Sanitary Sewer Master Plan. This basin was selected as a prototype for establishing planning criteria and data management processes. These protocols were applied to the City's remaining basins. The next phase of the Master Plan built upon the initial work by

- confirming wastewater flow criteria,
- evaluating and improving GIS sanitary sewer network integrity,
- applying a Capacity Model approach per the City's *Sanitary Sewer Design Technical Manual*,
- developing a process for assessing sewer system condition and rehabilitation,
- and identifying collection system deficiencies for all sewer system basins.

After completion of the Central Business District basin, the Master Plan focused on basins with Areas of Change as defined by *Blueprint Denver*. Locations in the Areas of Change include the new growth areas of Lowry, Stapleton, Gateway, downtown, areas around transit stations, and areas along major streets and/or transportation corridors. These locations benefit from an infusion of population, economic activity, and investment. The final effort of this Master Plan analyzed the remainder of the City for deficiencies, and developed recommended capital improvements for implementation based solely upon capacity.

3.9 Water Quality Considerations

There is concern that sanitary sewer pipes could experience exfiltration with flow being intercepted by storm sewers and conveyed to the receiving waterways. The existing GIS network was used to characterize the interaction between the storm and sanitary sewer systems. The Denver GIS database was used to determine intersection crossings of storm and sanitary pipes. The greatest concern is intersections where sanitary pipes may be installed through storm pipes. Secondarily, there are concerns where storm pipes cross below sanitary pipes. This also applies to areas where the pipes are closely parallel or cross within 12-inches of each other. Areas where sanitary mains cross under storm pipes are noteworthy, but less of a direct threat to water quality. The ongoing Storm and Dry Weather Monitoring Program has been aided by identifying these areas of pipe intersections. Maintenance programs are being developed to inspect these critical storm/sanitary pipe intersections.

4.0 CAPITAL IMPROVEMENTS PROGRAM

4.1 Cost Modeling

Cost estimating is an important component of the master planning process. Costs have been compiled to assist in the evaluation of sanitary upgrades, and to provide for systematic capital budgeting for future improvement programs. Bid data has been obtained, from the City & County of Denver, for the period 1999 to 2005 and reflects typical construction practices within the City. To convert costs to 2008 dollars, from 2005 dollars, all costs were escalated 7% except for the cost of asphalt patch which was doubled. A detailed tabulation of all unit costs, and a listing by map group, is shown in the Technical Appendix and linked to the GIS database for project cost analysis. General unit costs (in 2008 dollars) are summarized below with sanitary sewer pipe costs charted in Figure 4.1.

- Sanitary Sewers:

8”	$ 64	per lineal foot
10”	$ 67	per lineal foot
12”	$ 71	per lineal foot
15”	$ 76	per lineal foot
18”	$ 81	per lineal foot
21”	$ 92	per lineal foot
24”	$ 102	per lineal foot
27” through 96”	$ 4.00	per inch diameter per lineal foot

- Jack and Bore Pipe: $ 21.40 per inch diameter foot
- Manholes: $ 3,040 each Type A (4’ diameter pipes less than 30”)
  $ 4,570 each Type A (5’ diameter pipes 30” to 36”)
  $ 7,865 each Type B (pipes greater than 42”)
  Tabulated in GIS and based on replacement of existing manholes
- Asphalt Patch (assumed 8-ft wider than the pipe diameter): $ 8.00 per sy-in ($145.46/ton) for assumed 9-inch full depth section
- Wet Utility Relocation Cost: $3,210 to $21,400 per crossing for storm sewer
  $1,070 for relocation/avoidance of water
  Wet utility crossings have been tabulated in GIS for each specific pipe run and are included in the cost model based upon the size of the conflicting pipe. Costs are for sleeving, relocation, and protection during construction.
- Dry Utility Administration Cost: 5% of direct construction costs

Removal of existing sanitary sewer pipe has been considered incidental to the new pipe construction and is included within the new pipe unit costs.

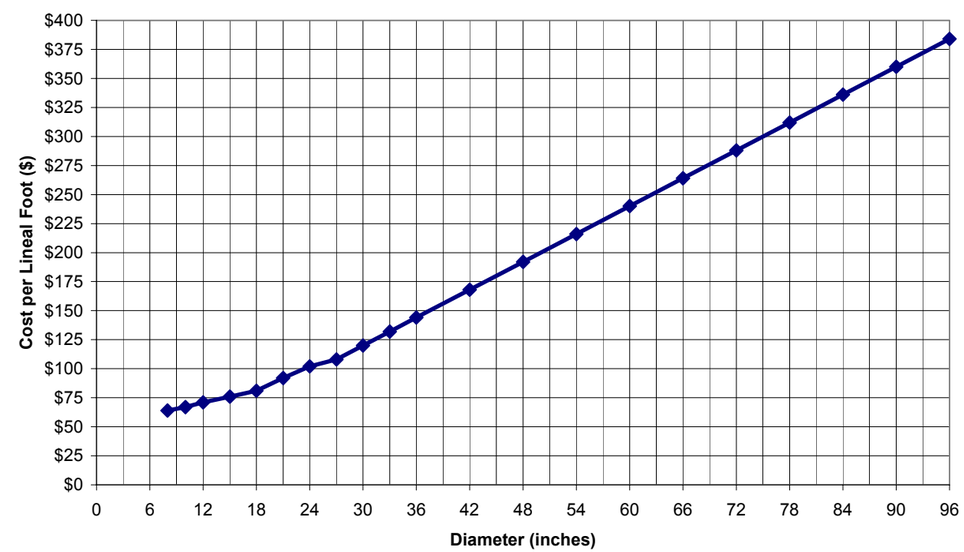
The following index values, from December 2008, can be used for future baseline comparison:

National Urban Consumer Price Index (CPI) = 210.228
Engineering News Record Construction Cost Index (ENR CCI) = 8551
CDOT Construction Cost Index (CDOT CCI) = 330.1

Indirect costs have been expressed as a percentage of direct construction costs. These include the following:

• Traffic Control:	3%
• Mobilization/Demobilization:	10%
• Engineering:	15%
• Materials Management (limited environmental remediation and disposal):	7%
• Contract Administration/Construction Management:	10%
• Contingency:	25%
INDIRECT COST TOTAL	70%

FIGURE 4.1 - MASTER PLANNING SANITARY SEWER PIPE OPINION OF PROBABLE COSTS



4.2 Summary of Capital Costs

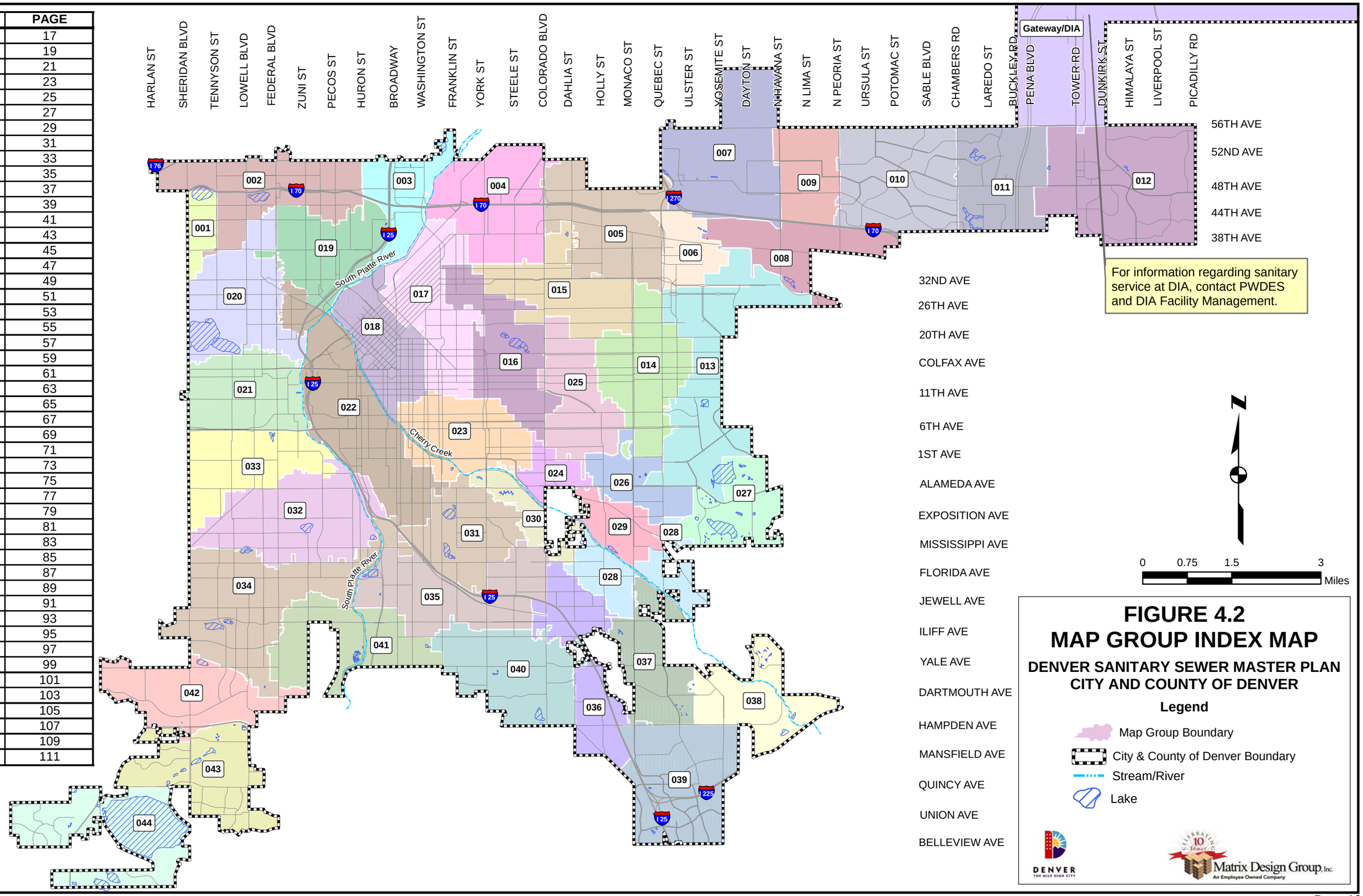
A summary of costs, for all map groups, is presented in Table 4.1 with Figure 4.2 depicting map group locations. The specific proposed features breakdown, of the cost estimate by map group, is shown on the adjoining page for every map group. Costs are tabulated programmatically using GIS and are based upon unit prices developed in 2008.

This Master Plan does not distinguish between developer cost and City cost. In particular, capital improvements have been shown for new developing areas (i.e., Stapleton). Their funding will be borne by different entities and budgets when compared to retro-fit improvements of existing development.

TABLE 4.1 - STATEMENT OF PROBABLE COSTS IN 2008 DOLLARS
SANITARY SEWER MASTER PLAN IMPROVEMENTS
CITY & COUNTY OF DENVER

		CONSTRUCTION COSTS						*INDIRECT COSTS*						
MAP GROUP	PAGE NO.	PIPE	MANHOLE	ASPHALT	DRY UTILITY RELOCATE	WET UTILITY RELOCATE	TOTAL CONSTRUCTION	TRAFFIC CONTROL	MOBILIZATION	ENGINEERING	MATERIALS MANAGEMENT	ADMINISTRATIVE	CONTINGENCY	TOTAL
001	16	$38,525	$9,120	$40,633	$4,548	$2,675	$95,501	$2,865	$9,550	$14,325	$6,685	$9,550	$23,875	$162,351
002	18	$121,876	$39,520	$110,184	$15,104	$30,495	$317,179	$9,515	$31,718	$47,577	$22,203	$31,718	$79,295	$539,205
003	20	$380,105	$88,160	$378,827	$44,789	$48,685	$940,566	$28,217	$94,057	$141,085	$65,840	$94,057	$235,142	$1,598,964
004	22	$578,168	$132,525	$517,885	$64,880	$69,015	$1,362,473	$40,874	$136,247	$204,371	$95,373	$136,247	$340,618	$2,316,203
005	24	$1,094,113	$197,600	$1,003,774	$118,787	$80,250	$2,494,524	$74,836	$249,452	$374,179	$174,617	$249,452	$623,631	$4,240,691
006	26	$16,188	$9,120	$15,762	$2,160	$2,140	$45,370	$1,361	$4,537	$6,806	$3,176	$4,537	$11,342	$77,129
007	28	$46,029	$9,120	$48,548	$5,399	$4,280	$113,376	$3,401	$11,338	$17,006	$7,936	$11,338	$28,344	$192,739
008	30	$364,135	$54,720	$350,799	$39,874	$27,820	$837,348	$25,120	$83,735	$125,602	$58,614	$83,735	$209,337	$1,423,491
009	32	$2,541,456	$326,480	$1,794,035	$244,334	$224,700	$5,131,005	$153,930	$513,100	$769,651	$359,170	$513,100	$1,282,751	$8,722,707
010	34	$2,434,548	$287,490	$1,548,937	$221,520	$159,430	$4,651,925	$139,558	$465,192	$697,789	$325,635	$465,192	$1,162,981	$7,908,272
011	36	$2,391,312	$242,440	$1,258,963	$199,317	$93,625	$4,185,657	$125,570	$418,566	$627,849	$292,996	$418,566	$1,046,414	$7,115,618
012	38	$628,418	$121,210	$412,739	$60,633	$50,290	$1,273,290	$38,199	$127,329	$190,994	$89,130	$127,329	$318,322	$2,164,593
013	40	$85,833	$36,500	$87,011	$11,912	$28,890	$250,146	$7,504	$25,015	$37,522	$17,510	$25,015	$62,536	$425,248
014	44	$227,801	$63,860	$222,792	$27,167	$28,890	$570,510	$17,115	$57,051	$85,576	$39,936	$57,051	$142,628	$969,867
015	46	$72,109	$18,240	$73,054	$8,999	$16,585	$188,987	$5,670	$18,899	$28,348	$13,229	$18,899	$47,247	$321,279
016	48	$219,942	$70,000	$129,458	$22,709	$34,775	$476,884	$14,307	$47,688	$71,533	$33,382	$47,688	$119,221	$810,703
017	50	$428,392	$91,200	$388,509	$49,872	$89,345	$1,047,318	$31,420	$104,732	$157,098	$73,312	$104,732	$261,830	$1,780,442
018	52	$641,046	$288,355	$408,215	$72,846	$119,305	$1,529,767	$45,893	$152,977	$229,465	$107,084	$152,977	$382,442	$2,600,605
019	54	$165,798	$33,440	$160,933	$18,704	$13,910	$392,785	$11,784	$39,278	$58,918	$27,495	$39,278	$98,196	$667,734
020	56	$111,460	$35,225	$109,723	$13,650	$16,585	$286,643	$8,599	$28,664	$42,996	$20,065	$28,664	$71,661	$487,292
021	58	$649,272	$191,070	$618,472	$75,535	$51,895	$1,586,244	$47,587	$158,624	$237,937	$111,037	$158,624	$396,561	$2,696,614
022	60	$381,528	$158,730	$300,427	$44,362	$46,545	$931,592	$27,948	$93,159	$139,739	$65,211	$93,159	$232,898	$1,583,706
023	64	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
024	66	$113,425	$21,280	$101,695	$12,756	$18,725	$267,881	$8,036	$26,788	$40,182	$18,752	$26,788	$66,970	$455,397
025	68	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
026	70	$23,374	$18,240	$23,834	$3,861	$11,770	$81,079	$2,432	$8,108	$12,162	$5,676	$8,108	$20,270	$137,835
027	72	$154,712	$42,560	$158,677	$18,306	$10,165	$384,420	$11,533	$38,442	$57,663	$26,909	$38,442	$96,105	$653,514
028	74	$197,583	$48,640	$208,396	$23,614	$17,655	$495,888	$14,877	$49,589	$74,383	$34,712	$49,589	$123,972	$843,010
029	76	$51,715	$24,320	$54,055	$7,253	$14,980	$152,323	$4,570	$15,232	$22,848	$10,663	$15,232	$38,081	$258,949
030	78	$231,191	$69,920	$240,049	$30,803	$74,900	$646,863	$19,406	$64,686	$97,029	$45,280	$64,686	$161,716	$1,099,666
031	80	$254,077	$69,960	$247,445	$31,811	$64,735	$668,028	$20,041	$66,803	$100,204	$46,762	$66,803	$167,007	$1,135,648
032	82	$197,279	$53,465	$195,255	$22,942	$12,840	$481,781	$14,453	$48,178	$72,267	$33,725	$48,178	$120,445	$819,027
033	84	$62,626	$18,240	$61,807	$7,535	$8,025	$158,233	$4,747	$15,823	$23,735	$11,076	$15,823	$39,558	$268,995
034	86	$544,282	$144,665	$568,964	$67,095	$83,995	$1,409,001	$42,270	$140,900	$211,350	$98,630	$140,900	$352,250	$2,395,301
035	90	$735,613	$172,025	$681,311	$88,302	$177,085	$1,854,336	$55,630	$185,434	$278,150	$129,804	$185,434	$463,584	$3,152,372
036	92	$790,767	$179,360	$629,087	$87,558	$151,940	$1,838,712	$55,161	$183,871	$275,807	$128,710	$183,871	$459,678	$3,125,810
037	94	$76,593	$33,460	$76,188	$9,740	$8,560	$204,541	$6,136	$20,454	$30,681	$14,318	$20,454	$51,135	$347,719
038	96	$144,452	$42,560	$152,357	$18,306	$26,750	$384,425	$11,533	$38,442	$57,664	$26,910	$38,442	$96,106	$653,522
039	98	$1,005,605	$206,995	$907,343	$113,193	$143,915	$2,377,051	$71,312	$237,705	$356,558	$166,394	$237,705	$594,263	$4,040,988
040	100	$101,158	$64,370	$99,253	$14,684	$28,890	$308,355	$9,251	$30,836	$46,253	$21,585	$30,836	$77,089	$524,205
041	102	$354,200	$79,040	$346,485	$41,715	$54,570	$876,010	$26,280	$87,601	$131,402	$61,321	$87,601	$219,002	$1,489,217
042	104	$225,870	$57,760	$236,047	$27,883	$37,985	$585,545	$17,566	$58,554	$87,832	$40,988	$58,554	$146,386	$995,425
043	106	$157,001	$30,400	$150,829	$17,045	$2,675	$357,950	$10,738	$35,795	$53,692	$25,057	$35,795	$89,488	$608,515
044	108	$16,281	$12,160	$17,172	$2,414	$2,675	$50,702	$1,521	$5,070	$7,605	$3,549	$5,070	$12,676	$86,193
Gateway/DIA	110	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL		$19,055,858	$3,893,545	$15,135,929	$2,013,917	$2,192,965	$42,292,214	$1,268,766	$4,229,219	$6,343,833	$2,960,457	$4,229,219	$10,573,053	$71,896,761
PERCENTAGE		45%	9%	36%	5%	5%	100%	3%	10%	15%	7%	10%	25%	170%

MAP SHEET	PAGE
001	17
002	19
003	21
004	23
005	25
006	27
007	29
008	31
009	33
010	35
011	37
012	39
013A	41
013B	43
014	45
015	47
016	49
017	51
018	53
019	55
020	57
021	59
022A	61
022B	63
023	65
024	67
025	69
026	71
027	73
028	75
029	77
030	79
031	81
032	83
033	85
034A	87
034B	89
035	91
036	93
037	95
038	97
039	99
040	101
041	103
042	105
043	107
044	109
Gateway/DIA	111



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Index_Map.mxd, 12/2/2009, chris_martin

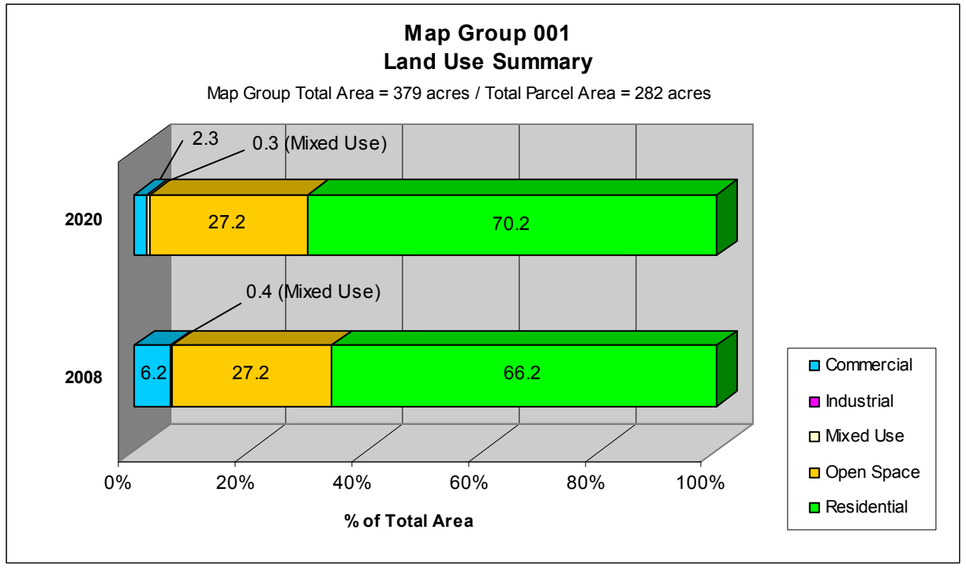
4.0 REFERENCES

- Carollo Engineers. *White Paper #1: Data Inventory and Unit Area Flow Projections for the Delgany Basin,* Draft June 2005.
- Carollo Engineers. *White Paper #2: Peak Hourly Flow Projections for the Delgany Basin,* Draft June 2005.
- City & County of Denver, *Blueprint Denver: An Integrated Land Use and Transportation Plan*, 2002.
- City & County of Denver, *Comprehensive Plan*, 2000.
- City & County of Denver, Department of Public Works Wastewater Management Division. *Sanitary Sewer Master Plan -Industrial/Commercial Water Consumption Study*, Draft, 1980 -1982.
- City & County of Denver, Department of Public Works Wastewater Management Division. *Sanitary Sewer Master Plan -Residential Water Consumption and Population Density Study*, Draft, 1980-1983.
- City & County of Denver, *GIS database* (includes parcels, pipes, and zoning), 2008.
- City & County of Denver, *Metro Vision 2030 Clean Water Plan*, 2005.
- City & County of Denver, *Sanitary Sewer Design Technical Manual*, 2008.
- City & County of Denver, Sanitary Sewer Master Plan, 1951.
- City & County of Denver, Sanitary Sewer Master Plan, 1974.
- City & County of Denver, Sanitary Sewer Master Plan, 1981.
- City & County of Denver, Sanitary Sewer Master Plan, 2006.
- Denver Business Journal, *Denver ranked No. 24 in population*. 2009 July 1. <http://denver.bizjournals.com/denver/stories/2009/06/29/daily36.html>. Accessed 2009 August 4.
- Denver Regional Council of Governments, *GIS database* (Traffic Analysis Zones), 2008.
- Denver Regional Council of Governments, *Socioeconomic Forecast Model*, 2007.
- Gaines, John. *Peak Sewage Flow Rate: Prediction and Probability*. Journal of the Water Pollution Control Federation, 61 (7), 1241-1248. 1989.
- Metropolitan Wastewater Reclamation District. *Service Area Utility Plan*, 2002.

This page intentionally blank

Map Group: 001 (W 44th Ave & N Sheridan Blvd)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

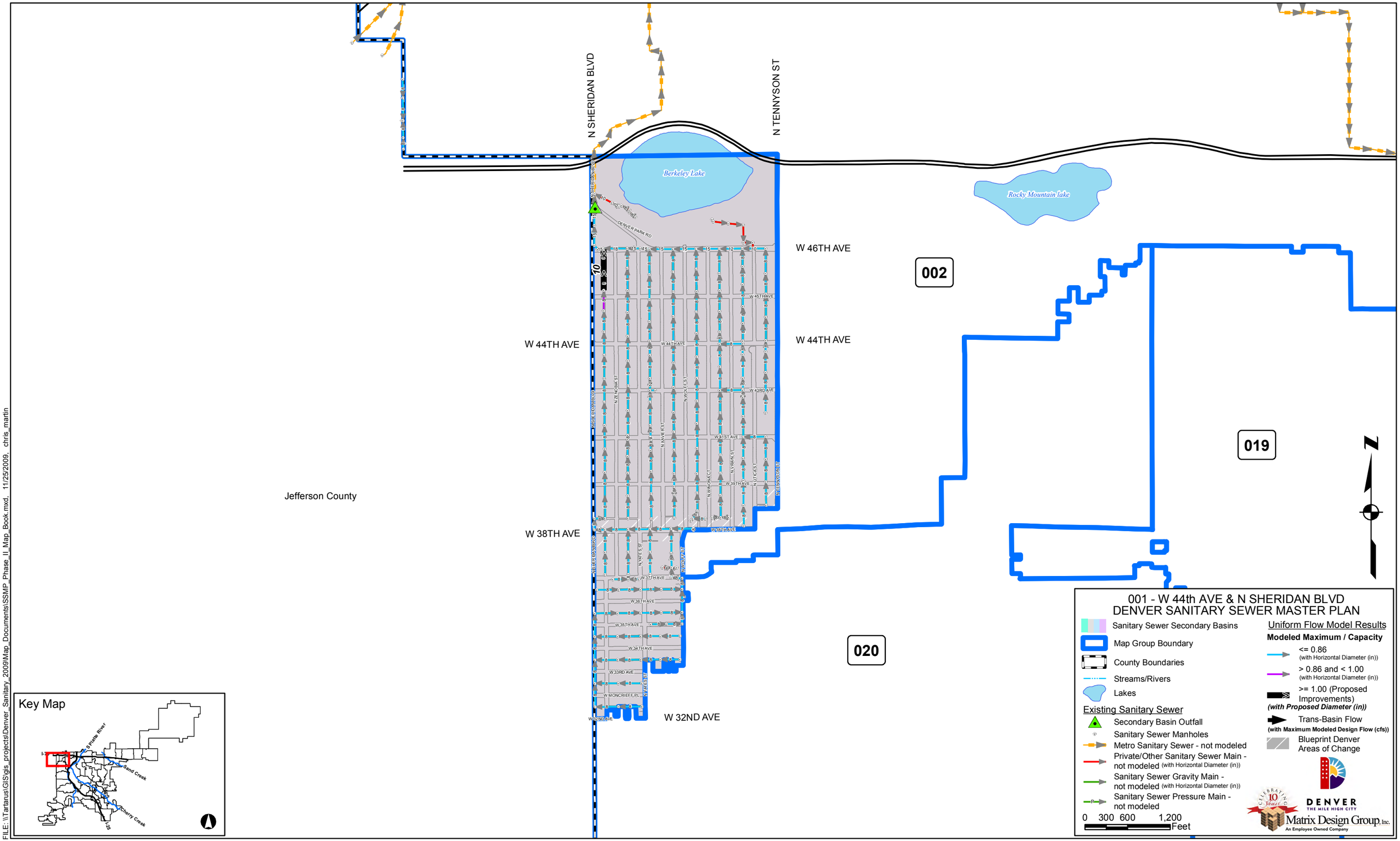
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	39	0.1
<= 0.86	46,949	98.1
> 0.86 & < 1	291	0.6
≥ 1 & < 2	576	1.2
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	47,854	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 001 COST ESTIMATE

SANITARY SEWER IMPROVEMENTS

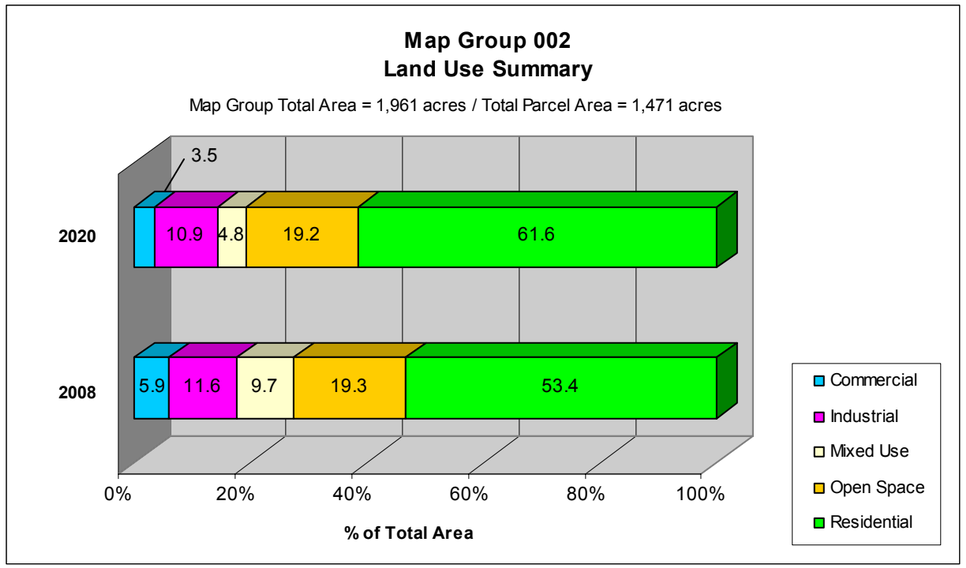
ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	575	LF	$67	$38,525
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	3	EA	$3,040	$9,120
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	5,079	SY-IN	$8	$40,633
WET UTILITY RELOCATE	1	EA		$2,675
DRY UTILITY RELOCATE			5%	$4,548
			SUBTOTAL	$95,501
TRAFFIC CONTROL			3%	$2,865
MOBILIZATION			10%	$9,550
ENGINEERING			15%	$14,325
MATERIALS MANAGEMENT			7%	$6,685
ADMINISTRATIVE			10%	$9,550
CONTINGENCY			25%	$23,875
	2008 ESTIMATED TOTAL COST			$162,351



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009, chris_martin

Map Group 002 (I-70 & N Pecos St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 002 COST ESTIMATE

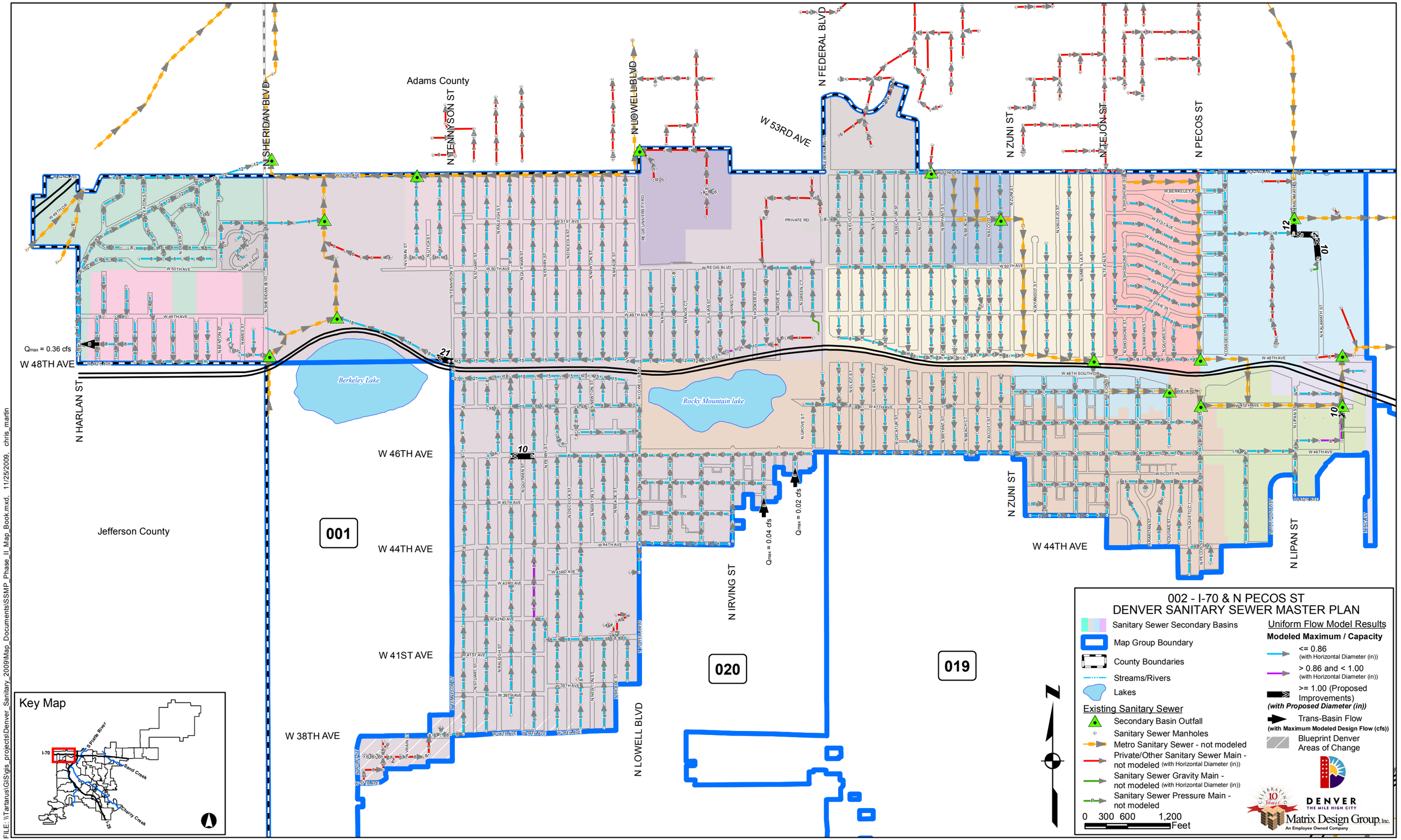
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	1,125	LF	$67	$75,375
12" DIAMETER PVC PIPE	164	LF	$71	$11,644
12" DIAMETER PVC PIPE (JACK & BORE)	49	LF	$257	$12,593
21" DIAMETER PVC PIPE	242	LF	$92	$22,264
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	13	EA	$3,040	$39,520
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	13,773	SY-IN	$8	$110,184
WET UTILITY RELOCATE	1	EA		$30,495
DRY UTILITY RELOCATE			5%	$15,104
			SUBTOTAL	$317,179
TRAFFIC CONTROL			3%	$9,515
MOBILIZATION			10%	$31,718
ENGINEERING			15%	$47,577
MATERIALS MANAGEMENT			7%	$22,203
ADMINISTRATIVE			10%	$31,718
CONTINGENCY			25%	$79,295
	2008 ESTIMATED TOTAL COST			$539,205

Model Output Summary - Denver Owned Gravity Mains

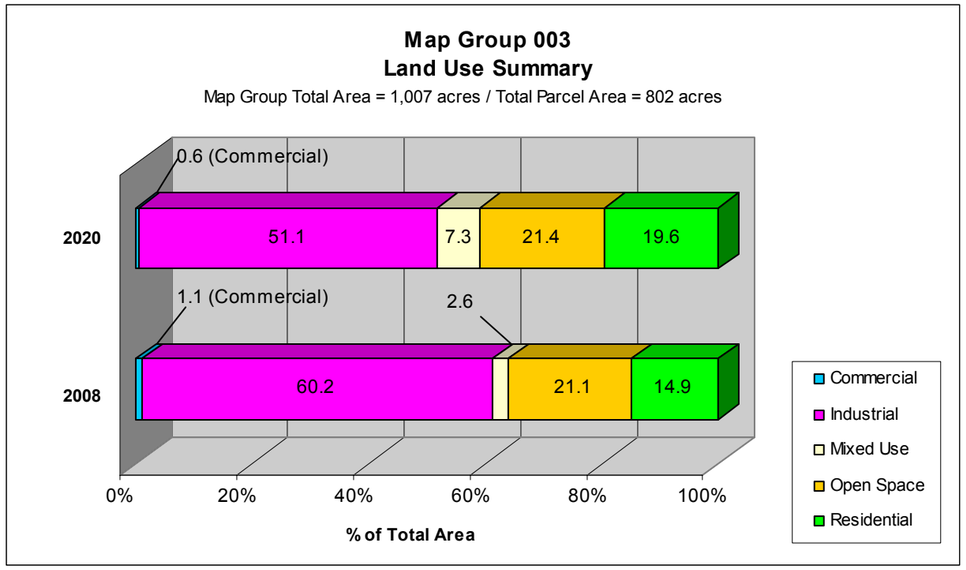
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	1,327	0.6
<= 0.86	214,604	97.8
> 0.86 & < 1	1,873	0.9
≥ 1 & < 2	1,579	0.7
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	219,383	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


002 - I-70 & N PECOS ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
Adams County
Jefferson County
N SHERIDAN BLVD
N TENNYSON ST
N LOWELL BLVD
N FEDERAL BLVD
W 53RD AVE
N ZUNI ST
N TEJON ST
N PECOS ST
W 52ND AVE
W 50TH AVE
W 49TH AVE
W 48TH AVE
W 48TH SOUTH DR
W 47TH AVE
W 46TH AVE
W 45TH AVE
W 44TH AVE
W 43RD AVE
W 42ND AVE
W 41ST AVE
W 39TH AVE
W 38TH AVE
N HARLAN ST
N LIPAN ST
N IRVING ST
W REGIS BLVD
REGIS UNIVERSITY RD
PRIVATE RD
Berkeley Lake
Rocky Mountain lake
Qmax = 0.36 cfs
Qmax = 0.04 cfs
Qmax = 0.02 cfs
001
020
019
21
10
12
N

Map Group 003 (I-70 & I-25)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 003 COST ESTIMATE

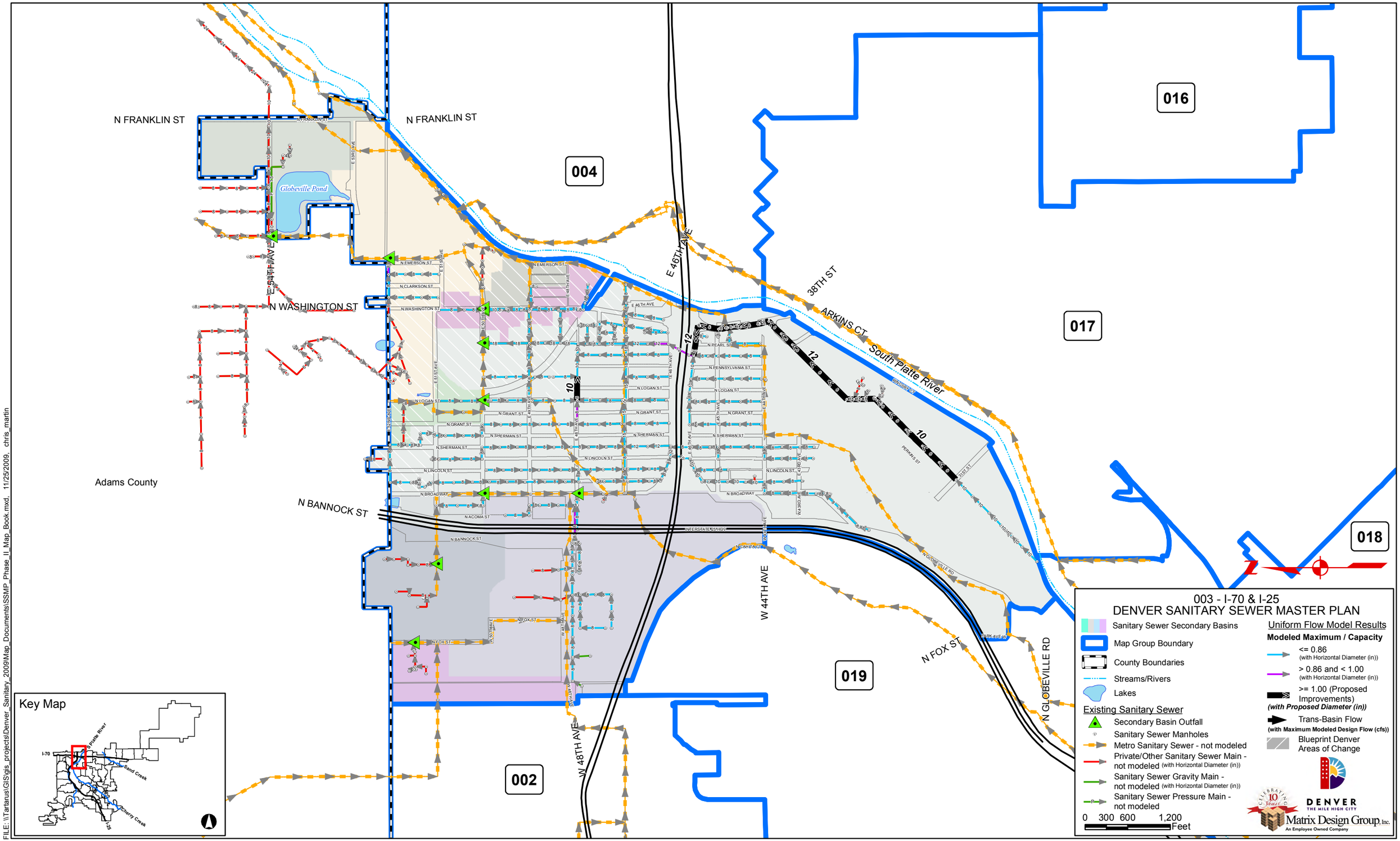
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	2,350	LF	$67	$157,450
12" DIAMETER PVC PIPE	2,955	LF	$71	$209,805
12" DIAMETER PVC PIPE (JACK & BORE)	50	LF	$257	$12,850
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	29	EA	$3,040	$88,160
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	47,353	SY-IN	$8	$378,827
WET UTILITY RELOCATE	1	EA		$48,685
DRY UTILITY RELOCATE			5%	$44,789
			SUBTOTAL	$940,566
TRAFFIC CONTROL			3%	$28,217
MOBILIZATION			10%	$94,057
ENGINEERING			15%	$141,085
MATERIALS MANAGEMENT			7%	$65,840
ADMINISTRATIVE			10%	$94,057
CONTINGENCY			25%	$235,142
	2008 ESTIMATED TOTAL COST			$1,598,964

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	394	0.6
<= 0.86	59,355	88.9
> 0.86 & < 1	1,651	2.5
≥ 1 & < 2	5,273	7.9
≥ 2 & < 4	0	0.0
≥ 4	81	0.1
Total	66,754	100

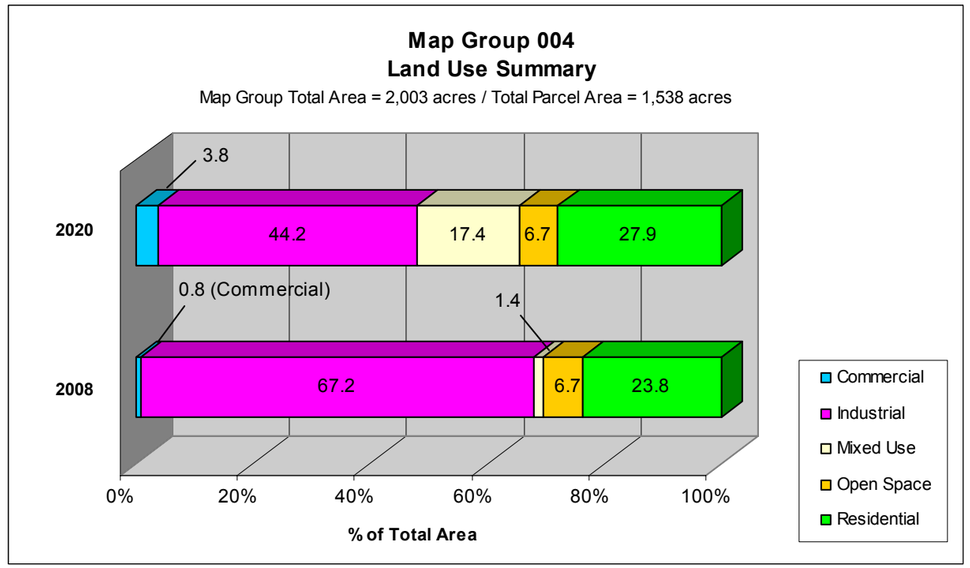
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 004 (1-70 & N York St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 004 COST ESTIMATE

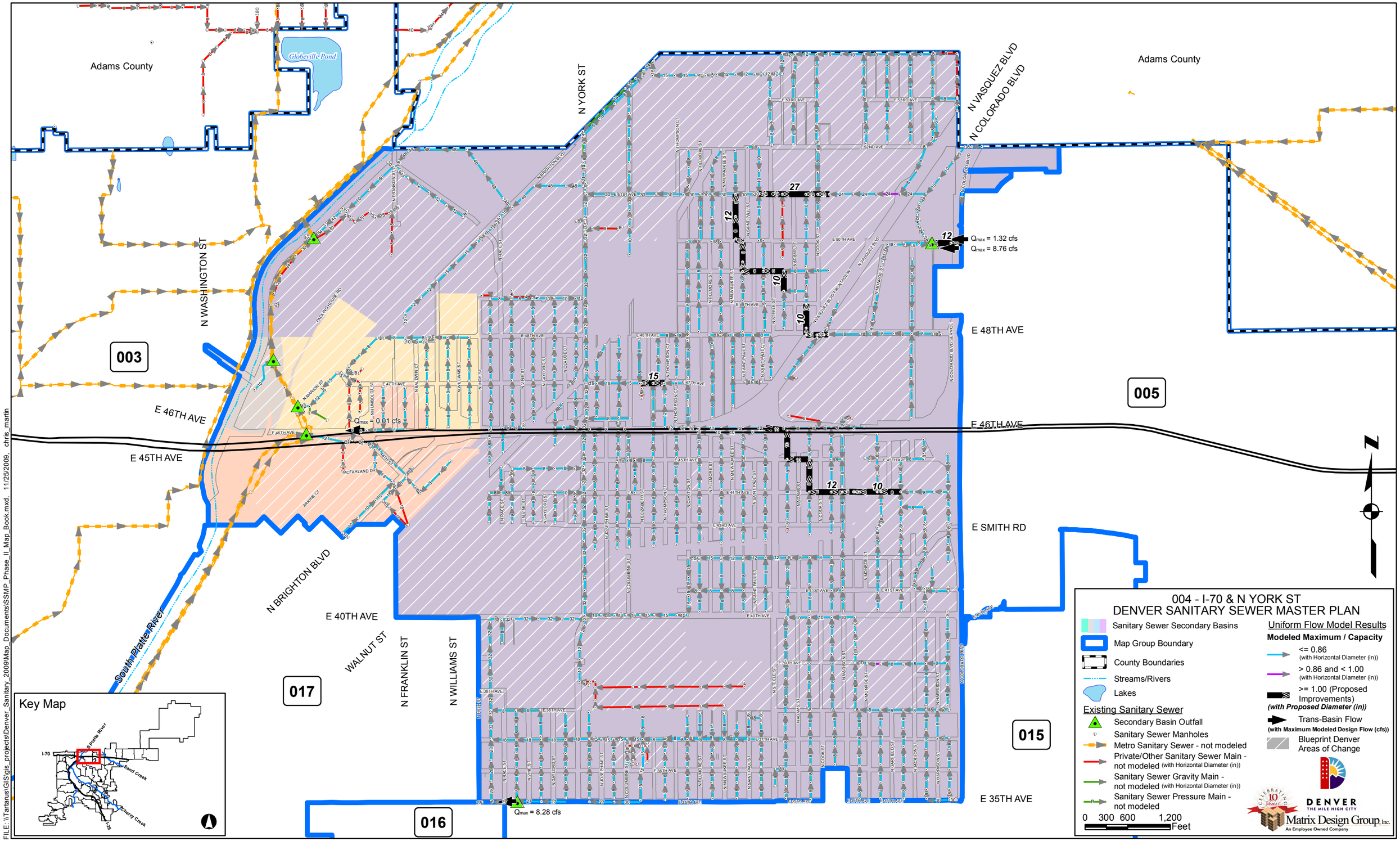
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	1,489	LF	$67	$99,763
10" DIAMETER PVC PIPE (JACK & BORE)	203	LF	$214	$43,442
12" DIAMETER PVC PIPE	4,265	LF	$71	$302,815
15" DIAMETER PVC PIPE	322	LF	$76	$24,472
27" DIAMETER PVC PIPE	997	LF	$108	$107,676
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	38	EA	$3,040	$115,520
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	2	EA	$4,570	$9,140
TYPE B MANHOLE WITH TYPE A TOP SLAB	1	EA	$7,865	$7,865
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	64,736	SY-IN	$8	$517,885
WET UTILITY RELOCATE	1	EA		$69,015
DRY UTILITY RELOCATE			5%	$64,880
			SUBTOTAL	$1,362,473
TRAFFIC CONTROL			3%	$40,874
MOBILIZATION			10%	$136,247
ENGINEERING			15%	$204,371
MATERIALS MANAGEMENT			7%	$95,373
ADMINISTRATIVE			10%	$136,247
CONTINGENCY			25%	$340,618
			2008 ESTIMATED TOTAL COST	$2,316,203

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	540	0.3
<= 0.86	201,706	96.0
> 0.86 & < 1	538	0.3
≥ 1 & < 2	5,904	2.8
≥ 2 & < 4	1,371	0.7
≥ 4	0	0.0
Total	210,059	100

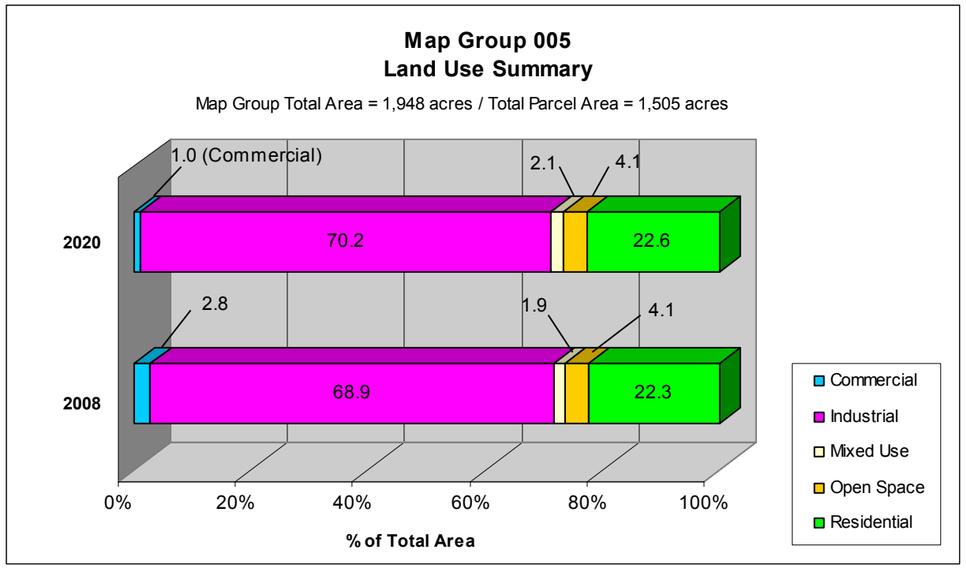
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 005 (1-70 & N Colorado Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 005 COST ESTIMATE

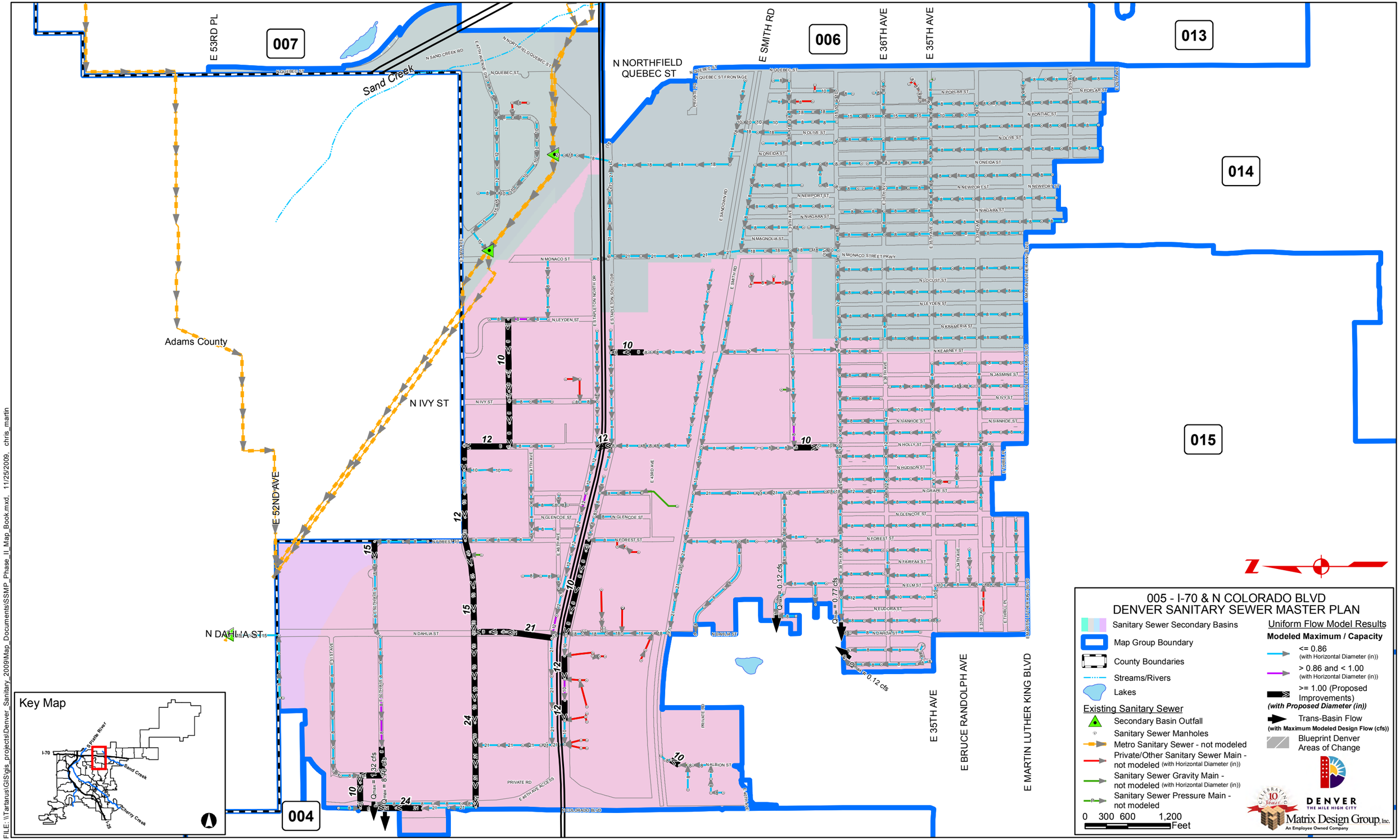
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	4,521	LF	$67	$302,907
10" DIAMETER PVC PIPE (JACK & BORE)	112	LF	$214	$23,968
12" DIAMETER PVC PIPE	3,298	LF	$71	$234,158
15" DIAMETER PVC PIPE	1,538	LF	$76	$116,888
21" DIAMETER PVC PIPE	1,129	LF	$92	$103,868
24" DIAMETER PVC PIPE	3,062	LF	$102	$312,324
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	65	EA	$3,040	$197,600
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	125,472	SY-IN	$8	$1,003,774
WET UTILITY RELOCATE	1	EA		$80,250
DRY UTILITY RELOCATE			5%	$118,787
			SUBTOTAL	$2,494,524
TRAFFIC CONTROL			3%	$74,836
MOBILIZATION			10%	$249,452
ENGINEERING			15%	$374,179
MATERIALS MANAGEMENT			7%	$174,617
ADMINISTRATIVE			10%	$249,452
CONTINGENCY			25%	$623,631
			2008 ESTIMATED TOTAL COST	$4,240,691

Model Output Summary - Denver Owned Gravity Mains

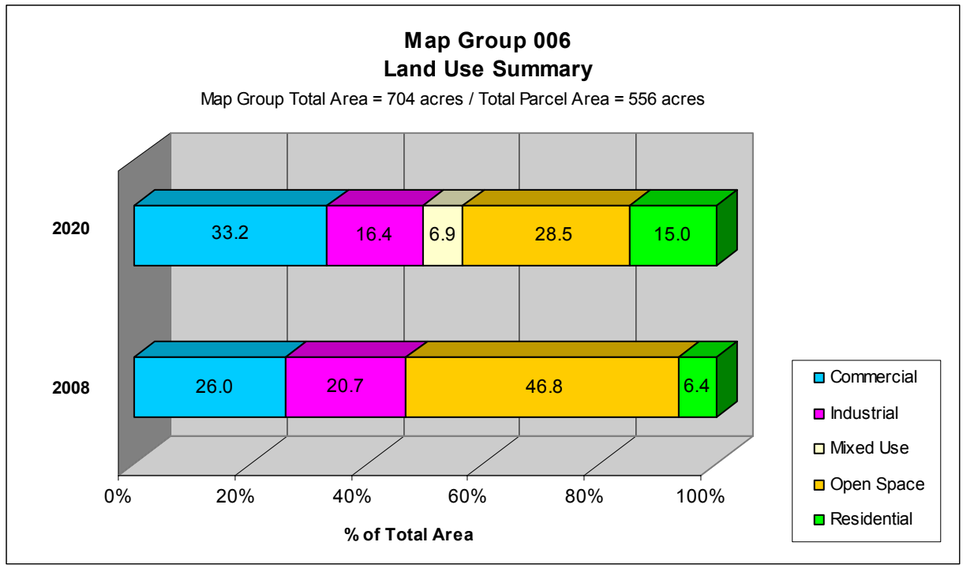
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	1,254	0.7
<= 0.86	158,171	90.5
> 0.86 & < 1	2,323	1.3
≥ 1 & < 2	10,101	5.8
≥ 2 & < 4	1,179	0.7
≥ 4	1,740	1.0
Total	174,768	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


005 - I-70 & N COLORADO BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
I-70
South Platte River
Sand Creek
Cherry Creek
007
006
013
014
015
004
E 53RD PL
N NORTHFIELD QUEBEC ST
E SMITH RD
E 36TH AVE
E 35TH AVE
Sand Creek
Adams County
N IVY ST
E 52ND AVE
N DAHLIA ST
E 35TH AVE
E BRUCE RANDOLPH AVE
E MARTIN LUTHER KING BLVD
Qmax = 0.12 cfs
Qmax = 0.77 cfs
Qmax = 0.32 cfs
Qmax = 8.76 cfs
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009, chris_martin

Map Group 006 (E Smith Rd & N Quebec St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 006 COST ESTIMATE

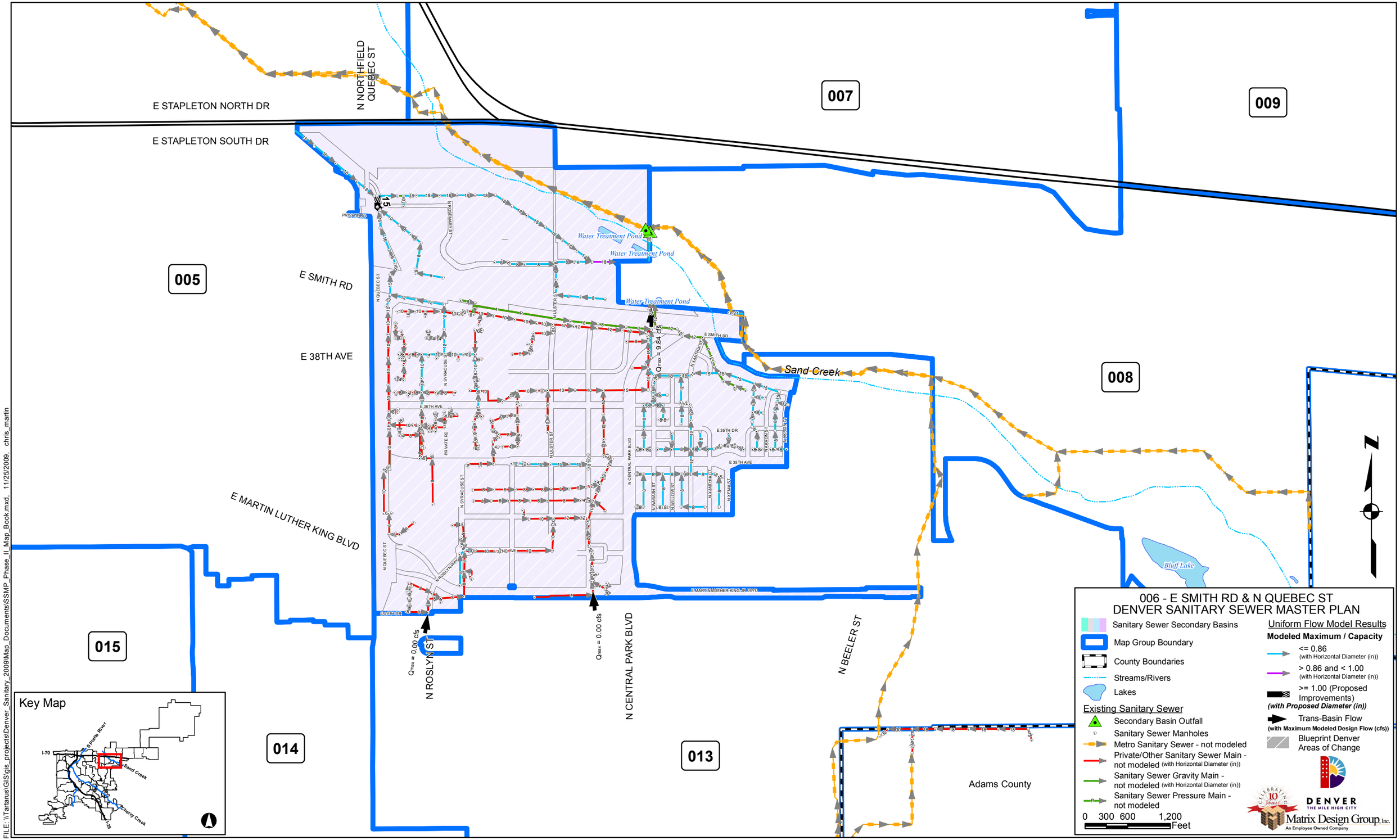
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
15" DIAMETER PVC PIPE	213	LF	$76	$16,188
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	3	EA	$3,040	$9,120
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	1,970	SY-IN	$8	$15,762
WET UTILITY RELOCATE	1	EA		$2,140
DRY UTILITY RELOCATE			5%	$2,160
			SUBTOTAL	$45,370
TRAFFIC CONTROL			3%	$1,361
MOBILIZATION			10%	$4,537
ENGINEERING			15%	$6,806
MATERIALS MANAGEMENT			7%	$3,176
ADMINISTRATIVE			10%	$4,537
CONTINGENCY			25%	$11,342
	2008 ESTIMATED TOTAL COST			$77,129

Model Output Summary - Denver Owned Gravity Mains

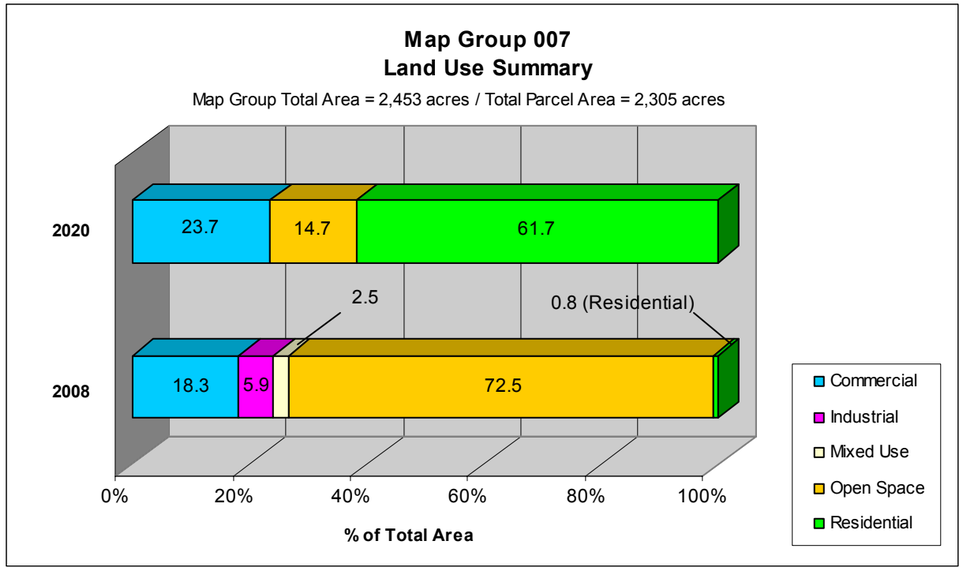
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	490	1.5
<= 0.86	31,558	96.8
> 0.86 & < 1	338	1.0
≥ 1 & < 2	0	0.0
≥ 2 & < 4	213	0.7
≥ 4	0	0.0
Total	32,599	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


006 - E SMITH RD & N QUEBEC ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
I-70
S Platte River
Sand Creek
Cherry Creek
I-25
E STAPLETON NORTH DR
E STAPLETON SOUTH DR
N NORTHFIELD QUEBEC ST
E SMITH RD
E 38TH AVE
E MARTIN LUTHER KING BLVD
N ROSLYN ST
N CENTRAL PARK BLVD
N BEELER ST
Sand Creek
Bluff Lake
Water Treatment Pond
Water Treatment Pond
Water Treatment Pond
Qmax = 9.84 cfs
Qmax = 0.00 cfs
Qmax = 0.00 cfs
007
009
005
008
015
014
013
Adams County
N
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 007 (E 56th Ave & N Havana St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 007 COST ESTIMATE

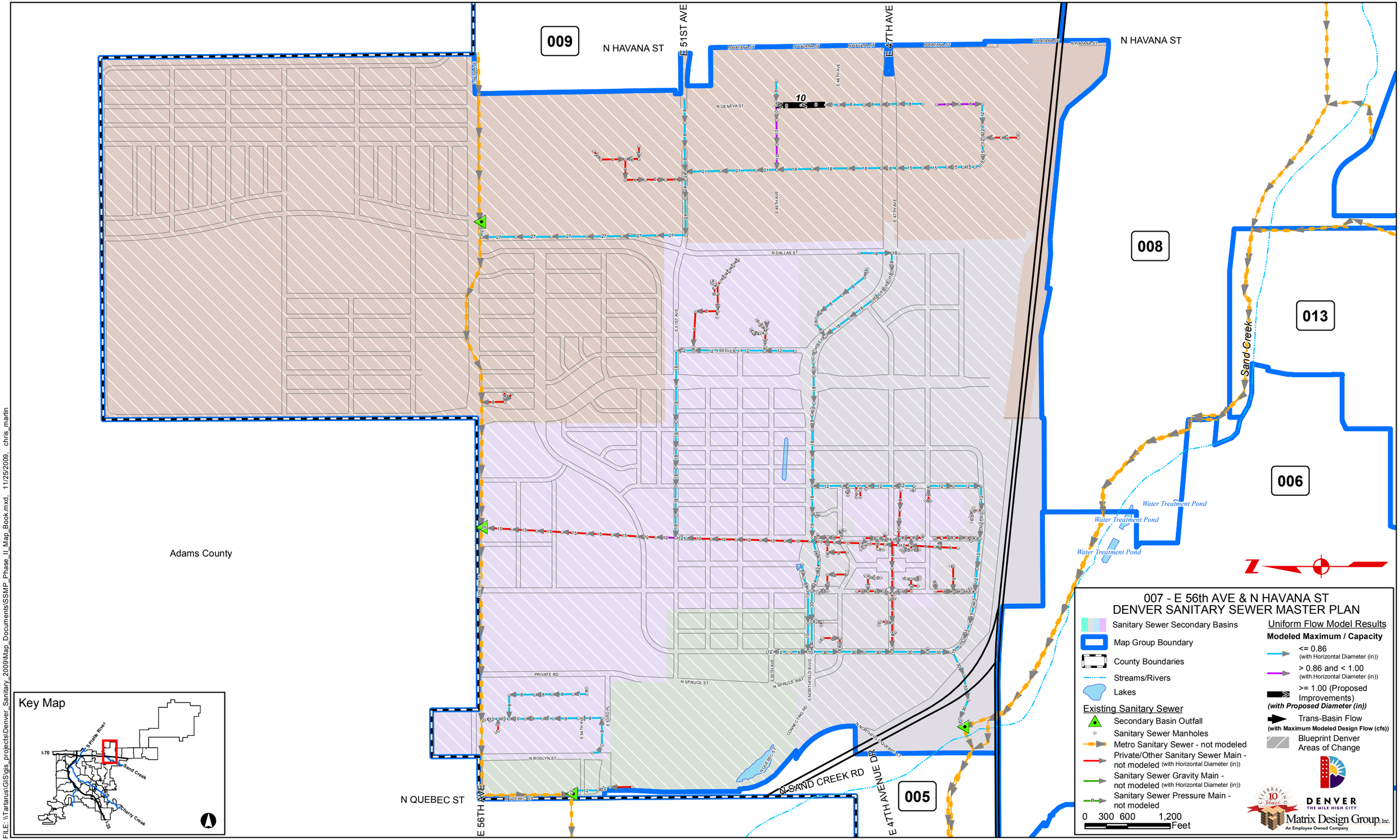
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	687	LF	$67	$46,029
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	3	EA	$3,040	$9,120
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	6,069	SY-IN	$8	$48,548
WET UTILITY RELOCATE	1	EA		$4,280
DRY UTILITY RELOCATE			5%	$5,399
			SUBTOTAL	$113,376
TRAFFIC CONTROL			3%	$3,401
MOBILIZATION			10%	$11,338
ENGINEERING			15%	$17,006
MATERIALS MANAGEMENT			7%	$7,936
ADMINISTRATIVE			10%	$11,338
CONTINGENCY			25%	$28,344
	2008 ESTIMATED TOTAL COST			$192,739

Model Output Summary - Denver Owned Gravity Mains

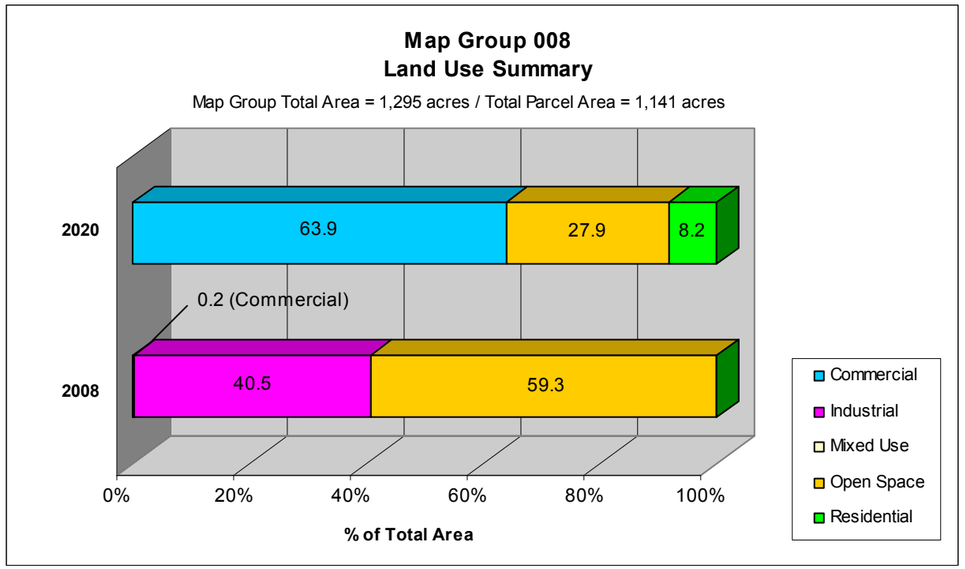
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	0	0.0
<= 0.86	38,360	93.8
> 0.86 & < 1	1,832	4.5
≥ 1 & < 2	687	1.7
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	40,879	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


009
N HAVANA ST
E 51ST AVE
E 47TH AVE
N HAVANA ST
008
013
006
005
Sand Creek
Water Treatment Pond
Water Treatment Pond
Water Treatment Pond
Adams County
N GENEVA ST
E 48TH AVE
E 49TH AVE
E 47TH AVE
N DALLAS ST
E 51ST AVE
N BEELER ST
N SPRUCE ST
N SPRUCE WAY
E 54TH AVE
NORTHFIELD BLVD
CONNECTING RD
PRIVATE RD
E 53RD PL
N ROSLYN ST
N QUEBEC ST
N NORTHFIELD QUEBEC ST
N SAND CREEK RD
E 47TH AVENUE DR
E 56TH AVE
N QUEBEC ST
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
I-25
007 - E 56th AVE & N HAVANA ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 008 (E Smith Rd & N Havana St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 008 COST ESTIMATE

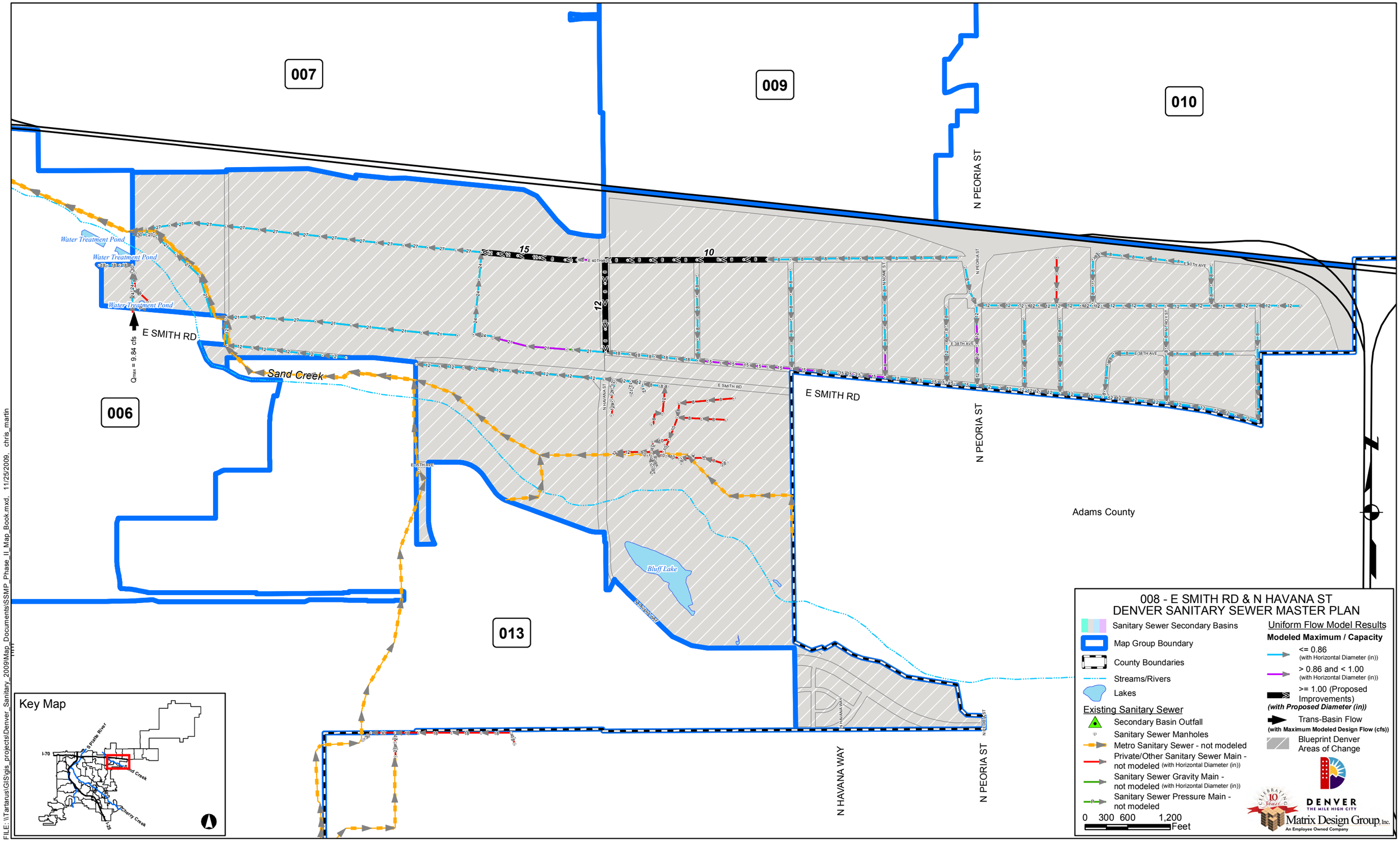
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	1,640	LF	$67	$109,880
12" DIAMETER PVC PIPE	1,909	LF	$71	$135,539
12" DIAMETER PVC PIPE (JACK & BORE)	30	LF	$257	$7,710
15" DIAMETER PVC PIPE	1,317	LF	$76	$100,092
15" DIAMETER PVC PIPE (JACK & BORE)	34	LF	$321	$10,914
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	18	EA	$3,040	$54,720
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	43,850	SY-IN	$8	$350,799
WET UTILITY RELOCATE	1	EA		$27,820
DRY UTILITY RELOCATE			5%	$39,874
			SUBTOTAL	$837,348
TRAFFIC CONTROL			3%	$25,120
MOBILIZATION			10%	$83,735
ENGINEERING			15%	$125,602
MATERIALS MANAGEMENT			7%	$58,614
ADMINISTRATIVE			10%	$83,735
CONTINGENCY			25%	$209,337
	2008 ESTIMATED TOTAL COST			$1,423,491

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	208	0.4
<= 0.86	48,057	83.4
> 0.86 & < 1	4,439	7.7
≥ 1 & < 2	4,402	7.6
≥ 2 & < 4	527	0.9
≥ 4	0	0.0
Total	57,633	100

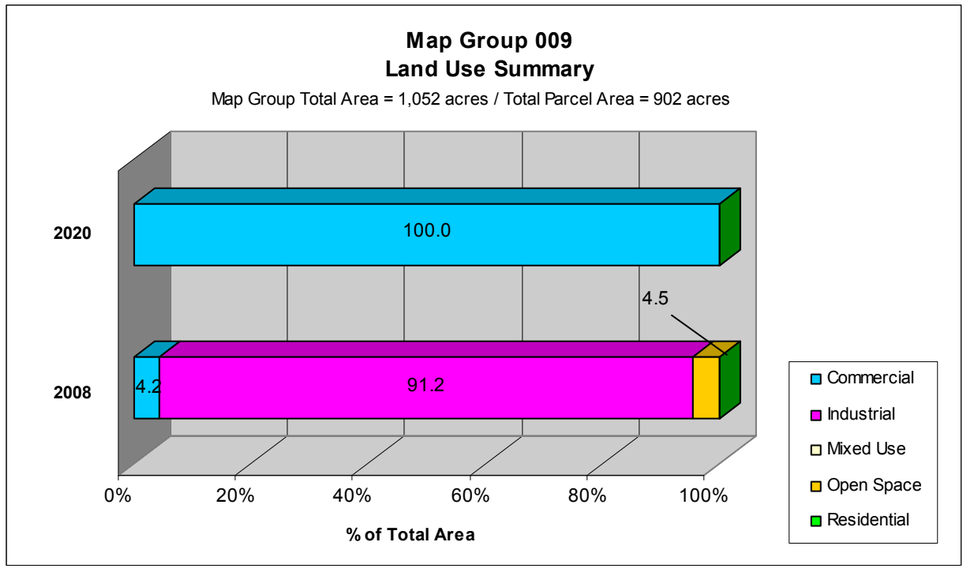
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 009 (E 56th Ave & N Havana St)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	360	0.5
<= 0.86	53,025	66.9
> 0.86 & < 1	3,281	4.1
≥ 1 & < 2	18,883	23.8
≥ 2 & < 4	3,682	4.6
≥ 4	0	0.0
Total	79,232	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 009 COST ESTIMATE

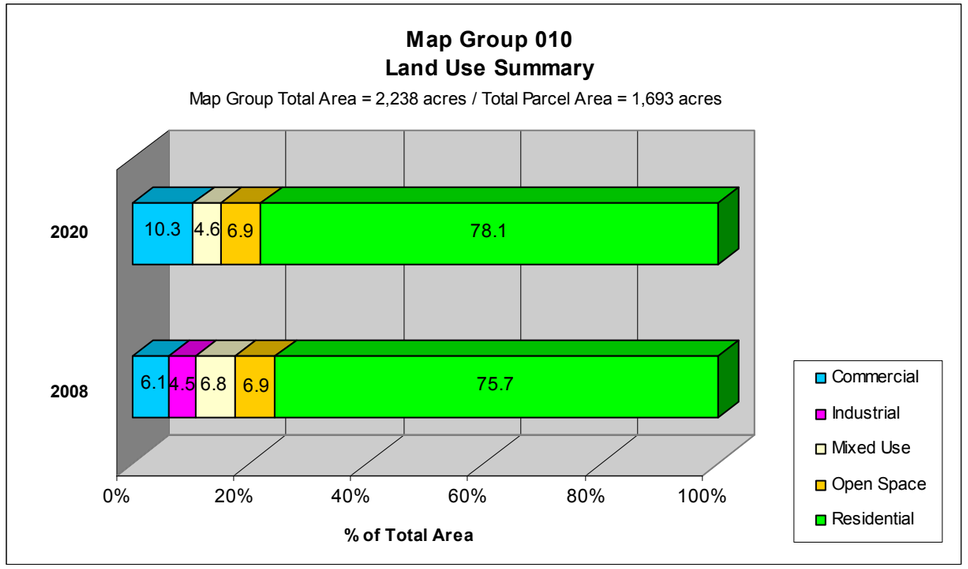
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	1,952	LF	$67	$130,784
10" DIAMETER PVC PIPE (JACK & BORE)	281	LF	$214	$60,134
12" DIAMETER PVC PIPE	2,584	LF	$71	$183,464
15" DIAMETER PVC PIPE	5,507	LF	$76	$418,532
15" DIAMETER PVC PIPE (JACK & BORE)	30	LF	$321	$9,630
18" DIAMETER PVC PIPE	2,574	LF	$81	$208,494
21" DIAMETER PVC PIPE	434	LF	$92	$39,928
24" DIAMETER PVC PIPE	4,355	LF	$102	$444,210
48" DIAMETER PVC PIPE	62	LF	$192	$11,904
54" DIAMETER PVC PIPE	4,761	LF	$216	$1,028,376
60" DIAMETER PVC PIPE	25	LF	$240	$6,000
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	66	EA	$3,040	$200,640
TYPE B MANHOLE WITH TYPE A TOP SLAB	16	EA	$7,865	$125,840
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	224,254	SY-IN	$8	$1,794,035
WET UTILITY RELOCATE	1	EA		$224,700
DRY UTILITY RELOCATE			5%	$244,334
			SUBTOTAL	$5,131,005
TRAFFIC CONTROL			3%	$153,930
MOBILIZATION			10%	$513,100
ENGINEERING			15%	$769,651
MATERIALS MANAGEMENT			7%	$359,170
ADMINISTRATIVE			10%	$513,100
CONTINGENCY			25%	$1,282,751
			2008 ESTIMATED TOTAL COST	$8,722,707

009 - E 56th AVE & N HAVANA ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Adams County
N PEORIA ST
E 56TH AVE
E 51ST AVE
E 47TH AVE
E ANDREWS DR
E ALBROOK DR
E 46TH AVE
E 45TH AVE
N PEORIA ST
Qmax = 60.51 cfs
Qmax = 13.58 cfs
007
008
010
Key Map
South Platte River
I-70
Sand Creek
Cherry Creek
25
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 010 (E 56th Ave & N Peoria St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 010 COST ESTIMATE

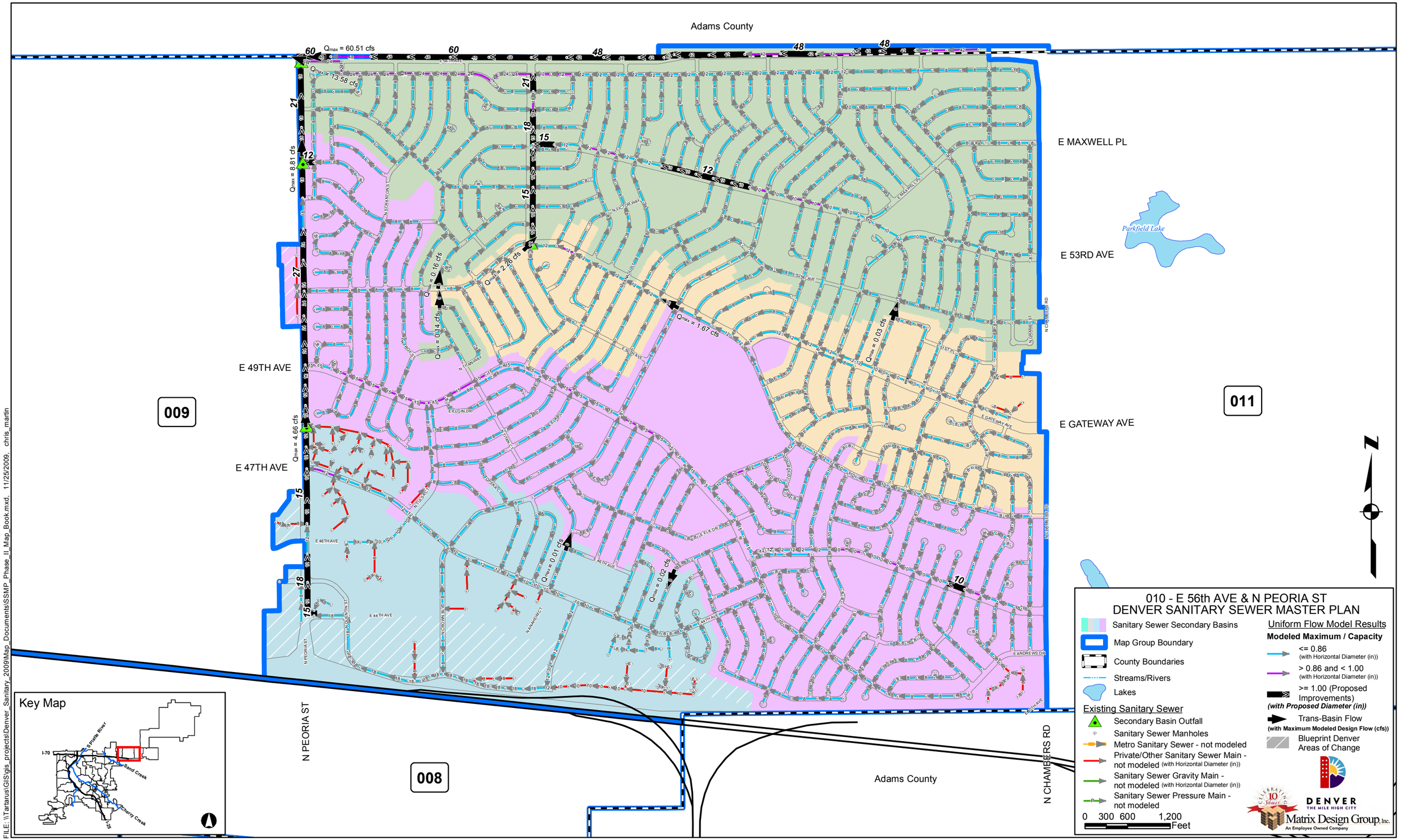
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	280	LF	$67	$18,760
12" DIAMETER PVC PIPE	1,451	LF	$71	$103,021
15" DIAMETER PVC PIPE	3,976	LF	$76	$302,176
18" DIAMETER PVC PIPE	1,291	LF	$81	$104,571
21" DIAMETER PVC PIPE	2,175	LF	$92	$200,100
27" DIAMETER PVC PIPE	1,916	LF	$108	$206,928
48" DIAMETER PVC PIPE	4,376	LF	$192	$840,192
60" DIAMETER PVC PIPE	2,745	LF	$240	$658,800
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	48	EA	$3,040	$145,920
TYPE B MANHOLE WITH TYPE A TOP SLAB	18	EA	$7,865	$141,570
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	193,617	SY-IN	$8	$1,548,937
WET UTILITY RELOCATE	1	EA		$159,430
DRY UTILITY RELOCATE			5%	$221,520
			SUBTOTAL	$4,651,925
TRAFFIC CONTROL			3%	$139,558
MOBILIZATION			10%	$465,192
ENGINEERING			15%	$697,789
MATERIALS MANAGEMENT			7%	$325,635
ADMINISTRATIVE			10%	$465,192
CONTINGENCY			25%	$1,162,981
			2008 ESTIMATED TOTAL COST	$7,908,272

Model Output Summary - Denver Owned Gravity Mains

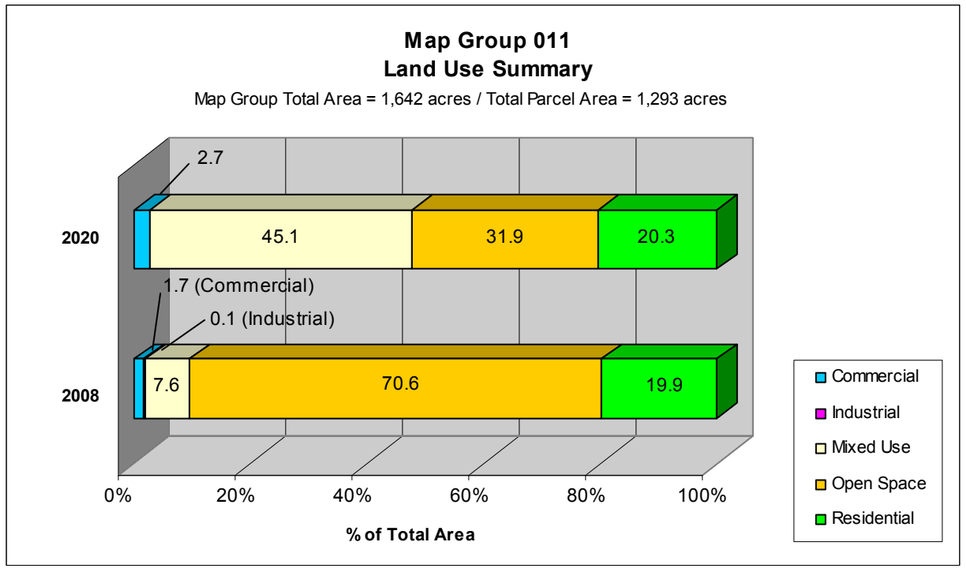
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	0	0.0
<= 0.86	330,872	91.3
> 0.86 & < 1	13,362	3.7
≥ 1 & < 2	18,039	5.0
≥ 2 & < 4	170	0.0
≥ 4	0	0.0
Total	362,443	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


010 - E 56th AVE & N PEORIA ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Adams County
E MAXWELL PL
E 53RD AVE
E GATEWAY AVE
E 49TH AVE
E 47TH AVE
N PEORIA ST
N CHAMBERS RD
Parkfield Lake
009
008
011
Key Map
I-70
S Platte River
Sand Creek
Cherry Creek
I-25
Qmax = 60.51 cfs
Qmax = 13.58 cfs
Qmax = 8.81 cfs
Qmax = 4.66 cfs
Qmax = 0.16 cfs
Qmax = 0.14 cfs
Qmax = 2.28 cfs
Qmax = 1.67 cfs
Qmax = 0.03 cfs
Qmax = 0.01 cfs
Qmax = 0.02 cfs
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 011 (E 56th Ave & N Chambers Rd)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

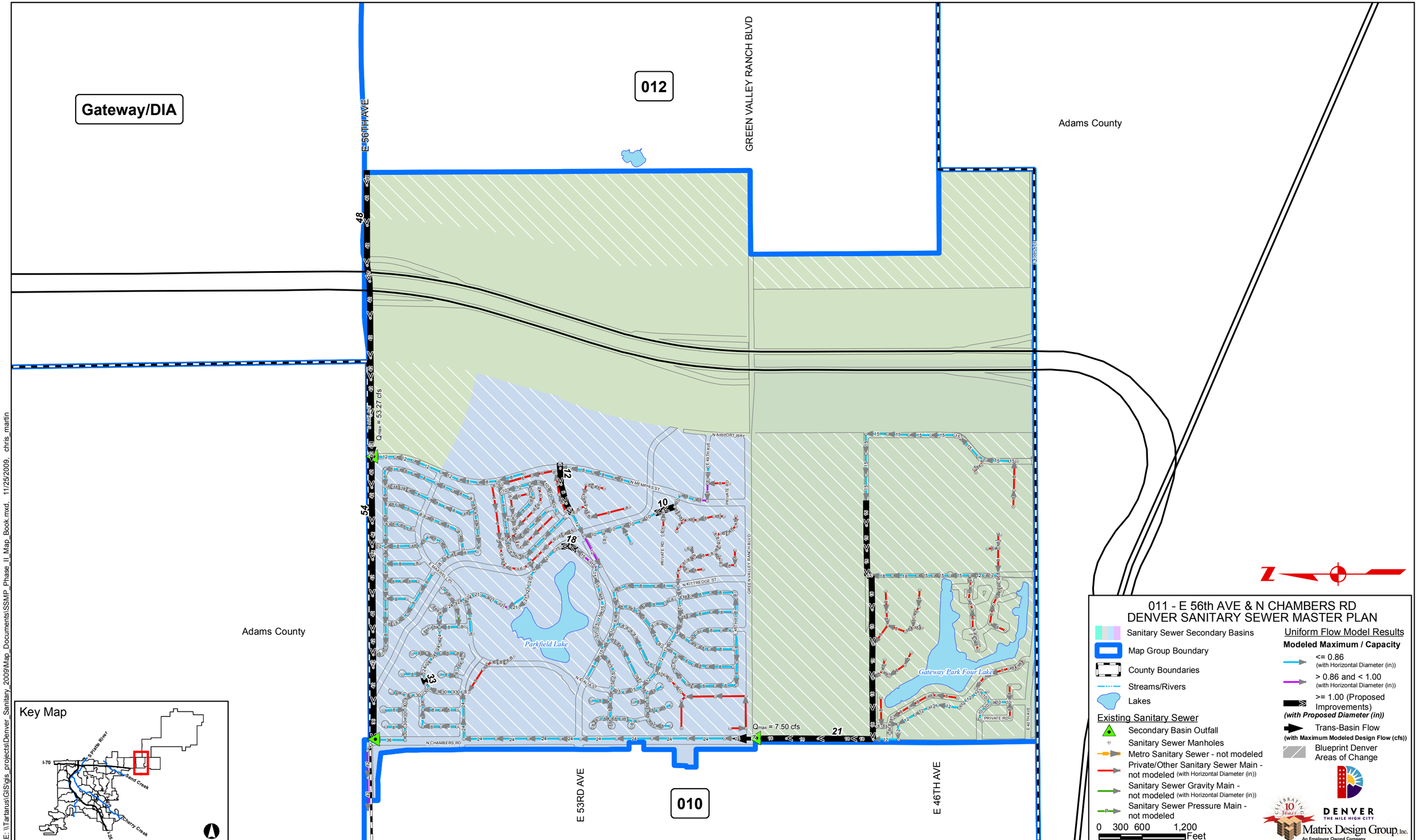
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	273	0.3
<= 0.86	64,310	79.0
> 0.86 & < 1	2,493	3.1
≥ 1 & < 2	13,642	16.8
≥ 2 & < 4	639	0.8
≥ 4	0	0.0
Total	81,357	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 011 COST ESTIMATE

SANITARY SEWER IMPROVEMENTS

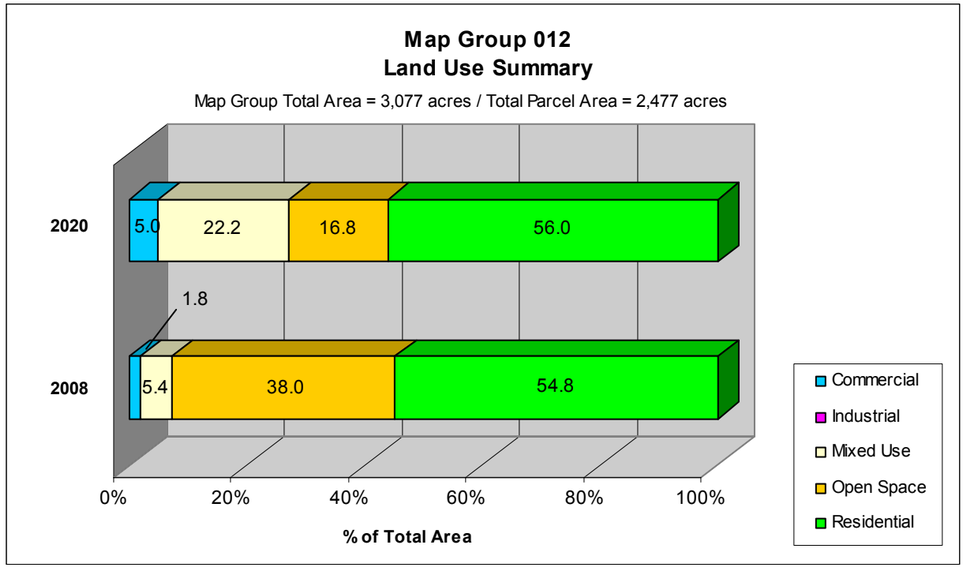
ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	284	LF	$67	$19,028
12" DIAMETER PVC PIPE	739	LF	$71	$52,469
18" DIAMETER PVC PIPE	225	LF	$81	$18,225
21" DIAMETER PVC PIPE	5,037	LF	$92	$463,404
33" DIAMETER PVC PIPE	74	LF	$132	$9,768
48" DIAMETER PVC PIPE	1,491	LF	$192	$286,272
48" DIAMETER PVC PIPE (JACK & BORE)	54	LF	$1,027	$55,458
54" DIAMETER PVC PIPE	6,262	LF	$216	$1,352,592
54" DIAMETER PVC PIPE (JACK & BORE)	116	LF	$1,156	$134,096
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	25	EA	$3,040	$76,000
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	2	EA	$4,570	$9,140
TYPE B MANHOLE WITH TYPE A TOP SLAB	20	EA	$7,865	$157,300
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	157,370	SY-IN	$8	$1,258,963
WET UTILITY RELOCATE	1	EA		$93,625
DRY UTILITY RELOCATE			5%	$199,317
			SUBTOTAL	$4,185,657
TRAFFIC CONTROL			3%	$125,570
MOBILIZATION			10%	$418,566
ENGINEERING			15%	$627,849
MATERIALS MANAGEMENT			7%	$292,996
ADMINISTRATIVE			10%	$418,566
CONTINGENCY			25%	$1,046,414
			2008 ESTIMATED TOTAL COST	$7,115,618



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 012 (E 48th Ave & N Tower Rd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 012 COST ESTIMATE

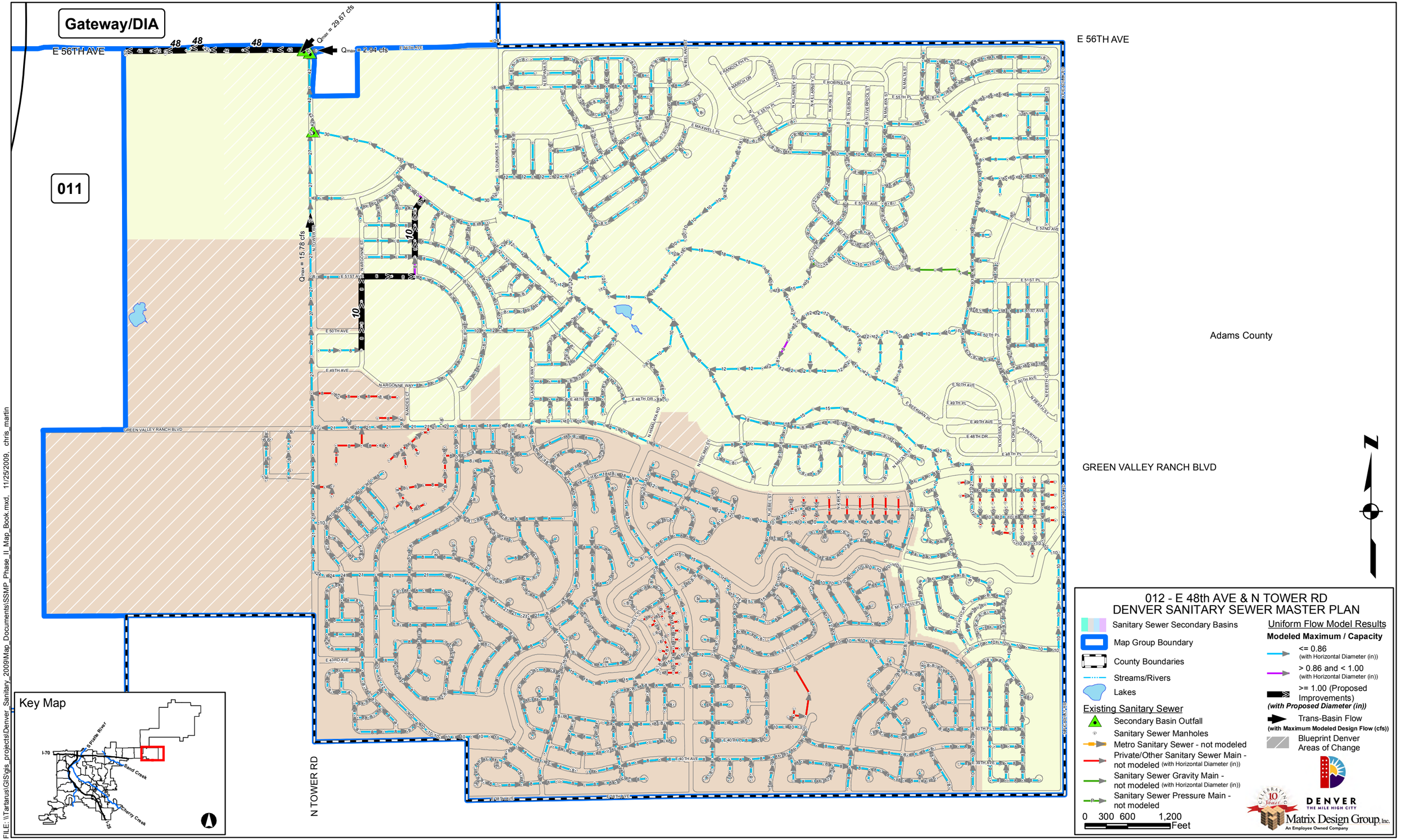
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
8" DIAMETER PVC PIPE	5	LF	$64	$320
10" DIAMETER PVC PIPE	2,646	LF	$67	$177,282
48" DIAMETER PVC PIPE	2,348	LF	$192	$450,816
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	14	EA	$3,040	$42,560
TYPE B MANHOLE WITH TYPE A TOP SLAB	10	EA	$7,865	$78,650
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	51,592	SY-IN	$8	$412,739
WET UTILITY RELOCATE	1	EA		$50,290
DRY UTILITY RELOCATE			5%	$60,633
			SUBTOTAL	$1,273,290
TRAFFIC CONTROL			3%	$38,199
MOBILIZATION			10%	$127,329
ENGINEERING			15%	$190,994
MATERIALS MANAGEMENT			7%	$89,130
ADMINISTRATIVE			10%	$127,329
CONTINGENCY			25%	$318,322
			2008 ESTIMATED TOTAL COST	$2,164,593

Model Output Summary - Denver Owned Gravity Mains

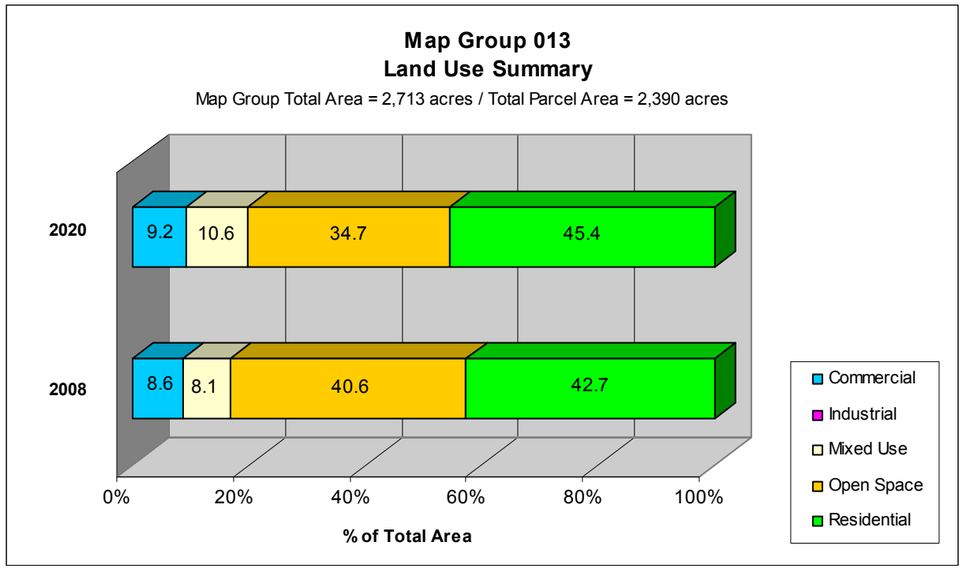
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	1,431	0.4
<= 0.86	331,786	97.9
> 0.86 & < 1	784	0.2
≥ 1 & < 2	4,994	1.5
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	338,996	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


Gateway/DIA
011
E 56TH AVE
Qmax = 29.67 cfs
Qmax = 2.94 cfs
Qmax = 15.78 cfs
E 56TH AVE
Adams County
GREEN VALLEY RANCH BLVD
N TOWER RD
E 48TH AVE
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
I-25
012 - E 48th AVE & N TOWER RD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 013 (E 26th Ave & N Roslyn St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 013 COST ESTIMATE

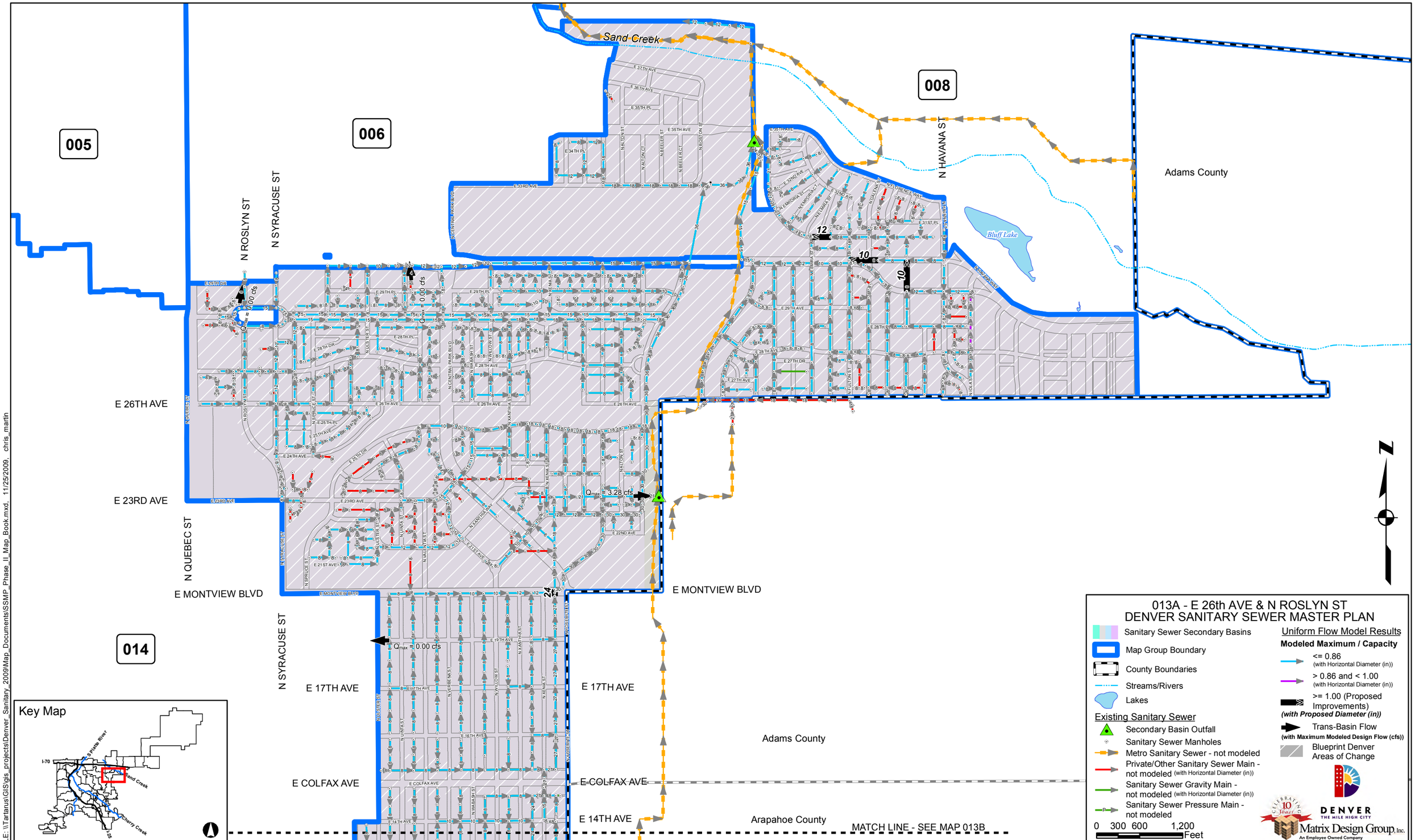
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	832	LF	$67	$55,744
12" DIAMETER PVC PIPE	283	LF	$71	$20,093
24" DIAMETER PVC PIPE	98	LF	$102	$9,996
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	9	EA	$3,040	$27,360
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	2	EA	$4,570	$9,140
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	10,876	SY-IN	$8	$87,011
WET UTILITY RELOCATE	1	EA		$28,890
DRY UTILITY RELOCATE			5%	$11,912
			SUBTOTAL	$250,146
TRAFFIC CONTROL			3%	$7,504
MOBILIZATION			10%	$25,015
ENGINEERING			15%	$37,522
MATERIALS MANAGEMENT			7%	$17,510
ADMINISTRATIVE			10%	$25,015
CONTINGENCY			25%	$62,536
	2008 ESTIMATED TOTAL COST			$425,248

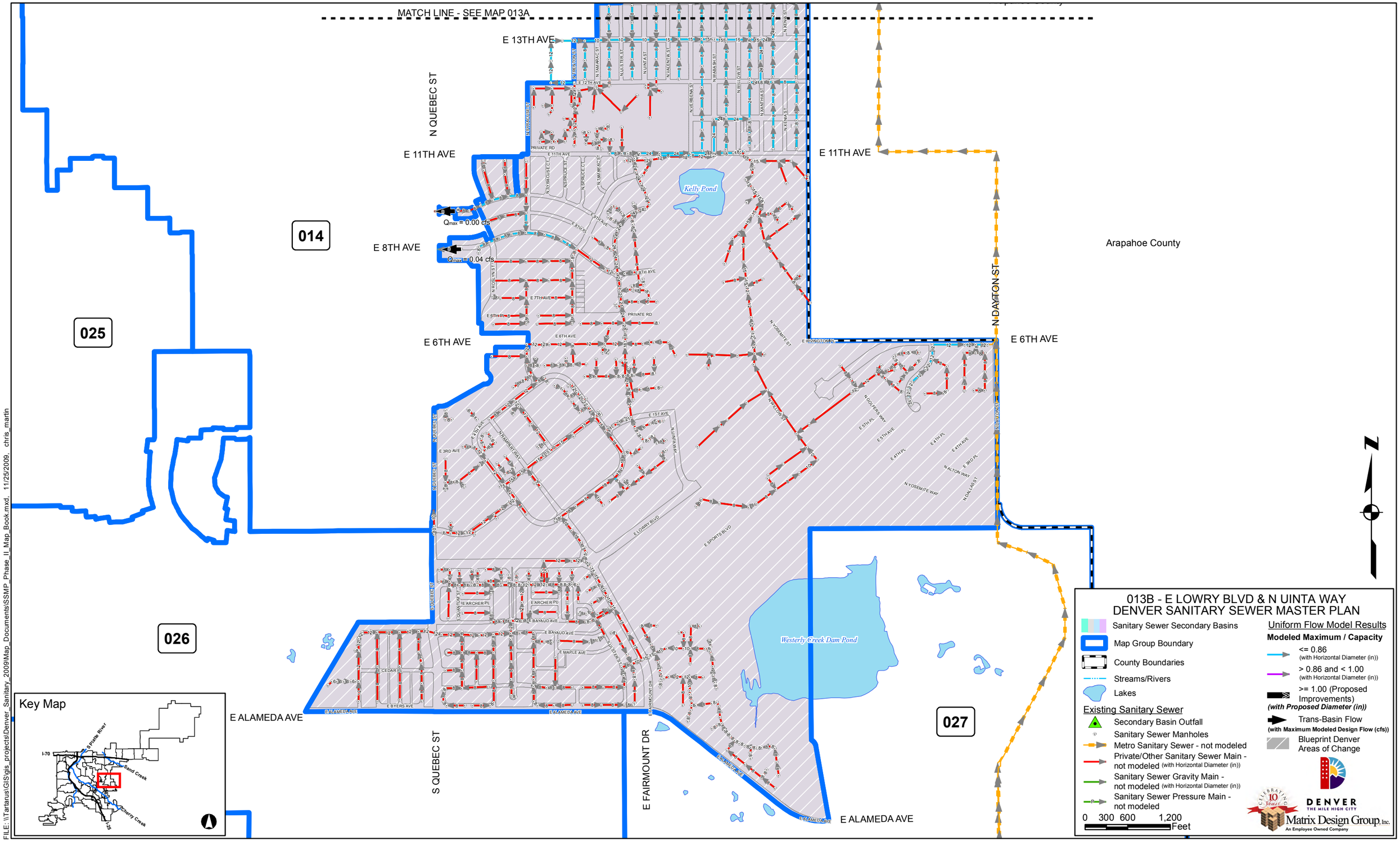
Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	517	0.2
<= 0.86	223,500	98.9
> 0.86 & < 1	724	0.3
≥ 1 & < 2	1,213	0.5
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	225,954	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

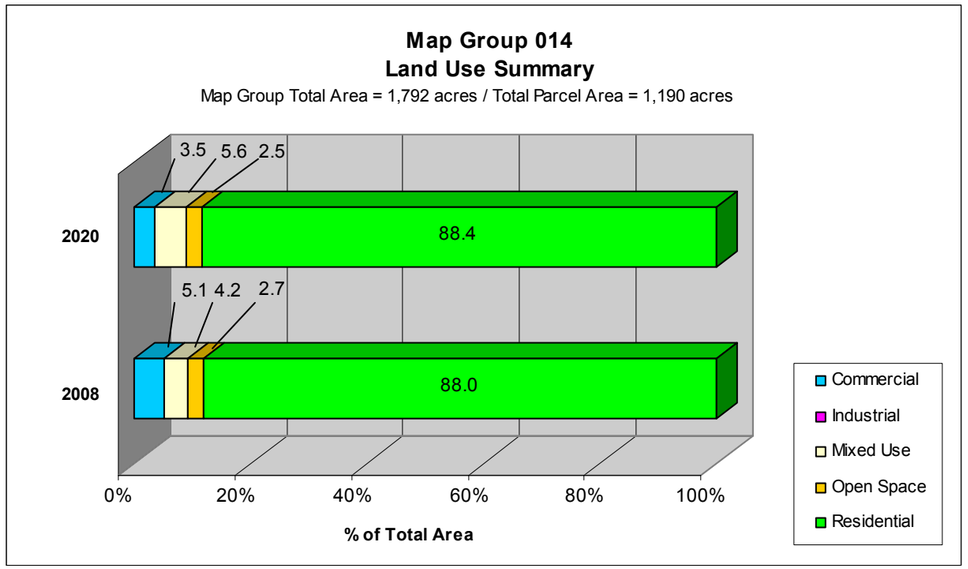

005
006
008
014
Sand Creek
Bluff Lake
Adams County
N ROSLYN ST
N SYRACUSE ST
N HAVANA ST
E 26TH AVE
E 23RD AVE
N QUEBEC ST
E MONTVIEW BLVD
E 17TH AVE
E COLFAX AVE
E 14TH AVE
Arapahoe County
MATCH LINE - SEE MAP 013B
Qmax = 0.00 cfs
Qmax = 3.28 cfs
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
I-25
013A - E 26th AVE & N ROSLYN ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

This page intentionally blank


MATCH LINE - SEE MAP 013A
E 13TH AVE
N QUEBEC ST
E 11TH AVE
E 11TH AVE
Kelly Pond
Qmax = 0.00 cfs
Qmax = 0.04 cfs
014
E 8TH AVE
Arapahoe County
N DAYTON ST
025
E 6TH AVE
E 6TH AVE
026
027
Westerly Creek Dam Pond
E ALAMEDA AVE
S QUEBEC ST
E FAIRMOUNT DR
E ALAMEDA AVE
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
25
013B - E LOWRY BLVD & N UINTA WAY
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 014 (E Colfax Ave & N Monaco Street Pkwy)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 014 COST ESTIMATE

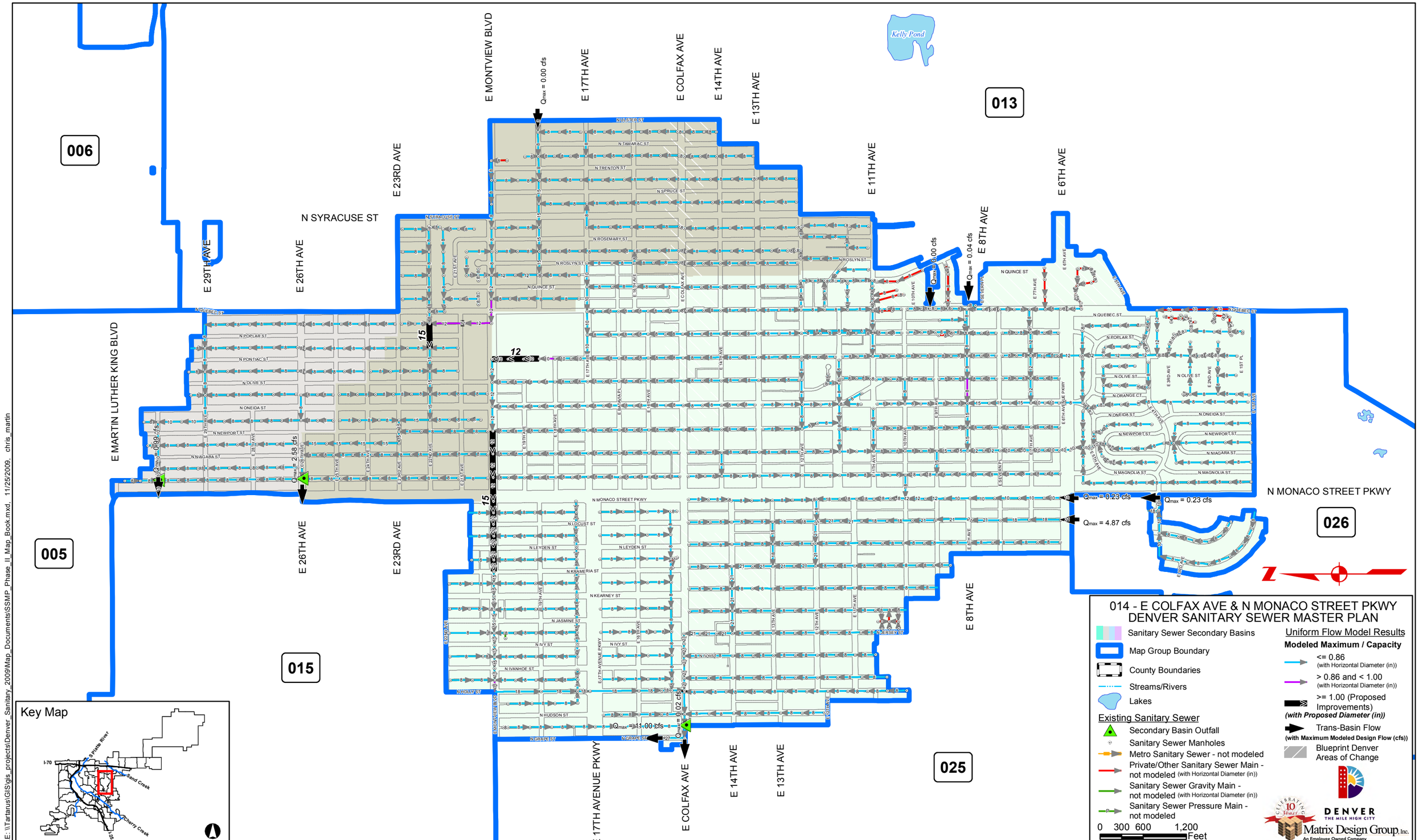
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
12" DIAMETER PVC PIPE	655	LF	$71	$46,505
15" DIAMETER PVC PIPE	2,349	LF	$76	$178,524
33" DIAMETER PVC PIPE	21	LF	$132	$2,772
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	18	EA	$3,040	$54,720
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	2	EA	$4,570	$9,140
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	27,849	SY-IN	$8	$222,792
WET UTILITY RELOCATE	1	EA		$28,890
DRY UTILITY RELOCATE			5%	$27,167
			SUBTOTAL	$570,510
TRAFFIC CONTROL			3%	$17,115
MOBILIZATION			10%	$57,051
ENGINEERING			15%	$85,576
MATERIALS MANAGEMENT			7%	$39,936
ADMINISTRATIVE			10%	$57,051
CONTINGENCY			25%	$142,628
	2008 ESTIMATED TOTAL COST			$969,867

Model Output Summary - Denver Owned Gravity Mains

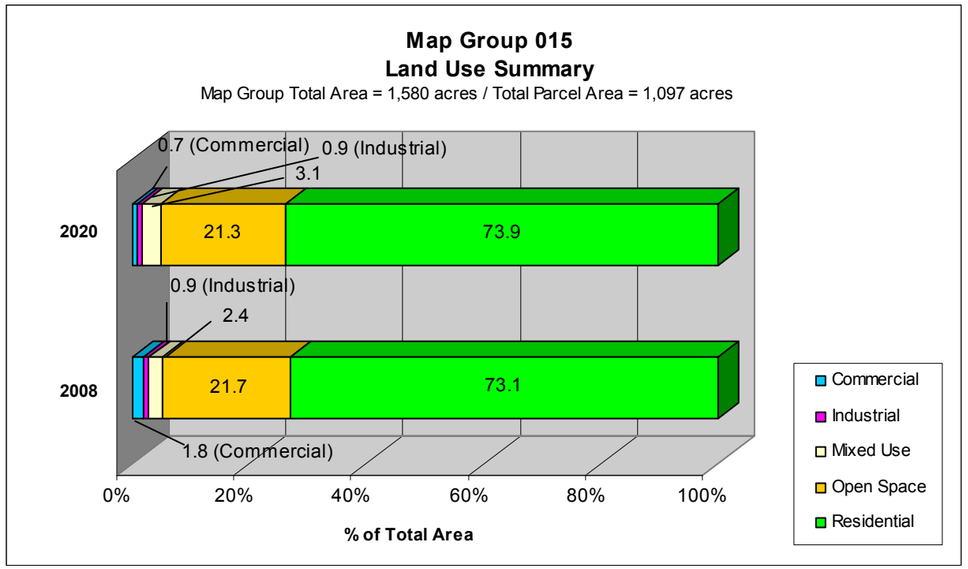
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	155	0.1
<= 0.86	262,470	98.1
> 0.86 & < 1	1,868	0.7
≥ 1 & < 2	3,023	1.1
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	267,516	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


014 - E COLFAX AVE & N MONACO STREET PKWY
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
006
005
015
013
026
025
E MARTIN LUTHER KING BLVD
E 29TH AVE
E 26TH AVE
E 23RD AVE
N SYRACUSE ST
E MONTVIEW BLVD
E 17TH AVE
E COLFAX AVE
E 14TH AVE
E 13TH AVE
E 11TH AVE
E 8TH AVE
E 6TH AVE
N MONACO STREET PKWY
E 17TH AVENUE PKWY
Kelly Pond
Qmax = 0.00 cfs
Qmax = 0.04 cfs
Qmax = 0.99 cfs
Qmax = 2.58 cfs
Qmax = 0.23 cfs
Qmax = 4.87 cfs
Qmax = 11.00 cfs
Qmax = 0.02 cfs
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 015 (E MLK Blvd & N Colorado Blvd)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

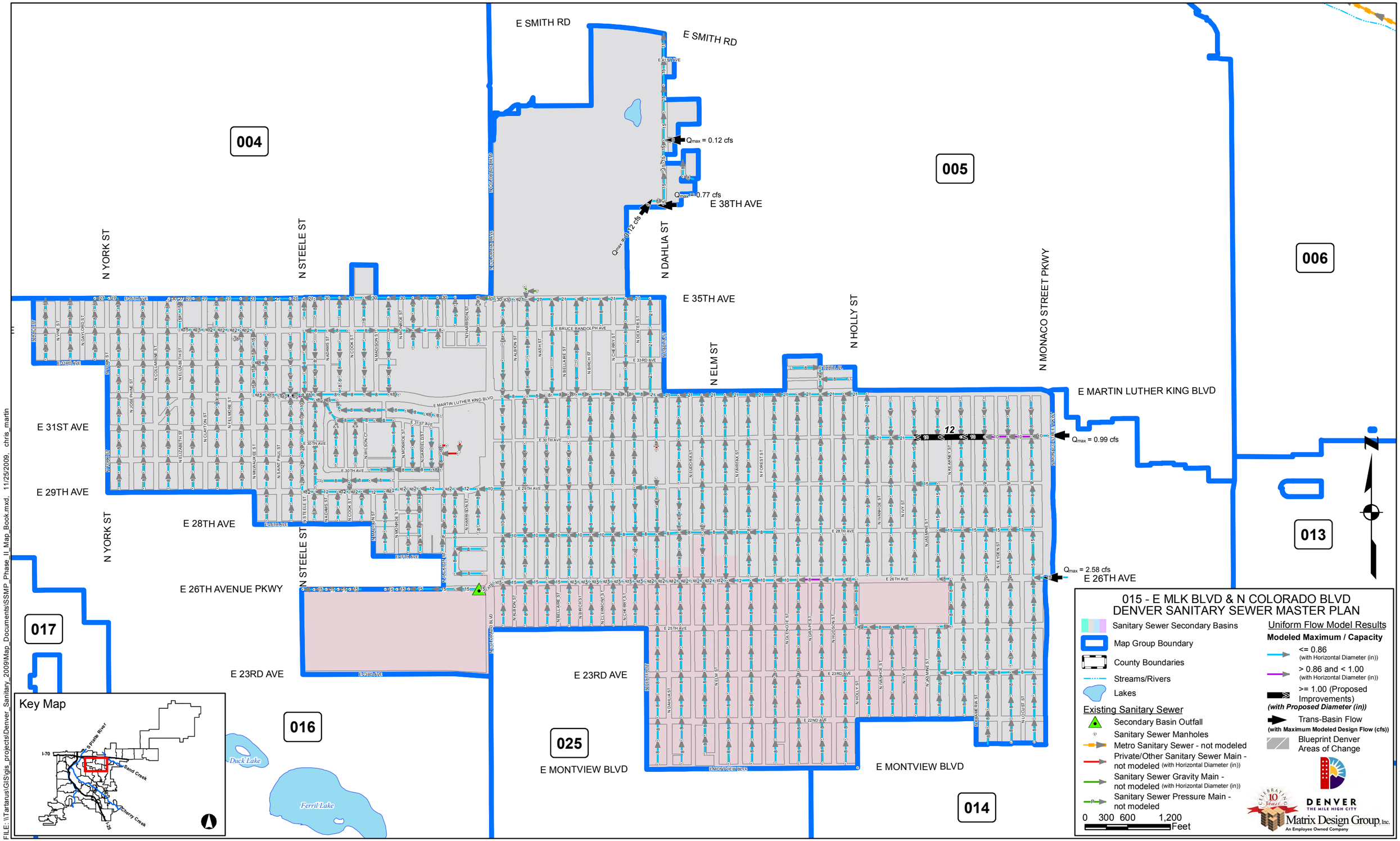
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	711	0.3
<= 0.86	202,356	98.5
> 0.86 & < 1	1,343	0.7
≥ 1 & < 2	1,014	0.5
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	205,425	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 015 COST ESTIMATE

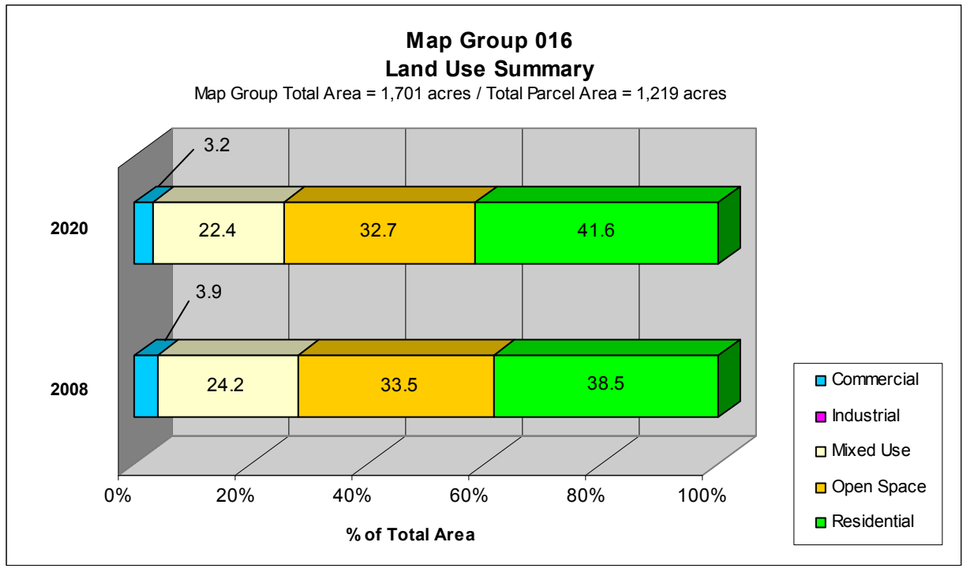
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
12" DIAMETER PVC PIPE	991	LF	$71	$70,361
15" DIAMETER PVC PIPE	23	LF	$76	$1,748
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	6	EA	$3,040	$18,240
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	9,132	SY-IN	$8	$73,054
WET UTILITY RELOCATE	1	EA		$16,585
DRY UTILITY RELOCATE			5%	$8,999
			SUBTOTAL	$188,987
TRAFFIC CONTROL			3%	$5,670
MOBILIZATION			10%	$18,899
ENGINEERING			15%	$28,348
MATERIALS MANAGEMENT			7%	$13,229
ADMINISTRATIVE			10%	$18,899
CONTINGENCY			25%	$47,247
	2008 ESTIMATED TOTAL COST			$321,279


015 - E MLK BLVD & N COLORADO BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
004
005
006
013
014
016
017
025
E SMITH RD
E 38TH AVE
E 35TH AVE
E MARTIN LUTHER KING BLVD
E 31ST AVE
E 29TH AVE
E 28TH AVE
E 26TH AVENUE PKWY
E 26TH AVE
E 23RD AVE
E MONTVIEW BLVD
N YORK ST
N STEELE ST
N DAHLIA ST
N ELM ST
N HOLLY ST
N MONACO STREET PKWY
N COLORADO BLVD
Qmax = 0.12 cfs
Qmax = 0.77 cfs
Qmax = 0.12 cfs
Qmax = 0.99 cfs
Qmax = 2.58 cfs
Duck Lake
Ferril Lake
S Platte River
Sand Creek
Cherry Creek
I-70
I-25
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 016 (E 17th Ave & N York St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 016 COST ESTIMATE

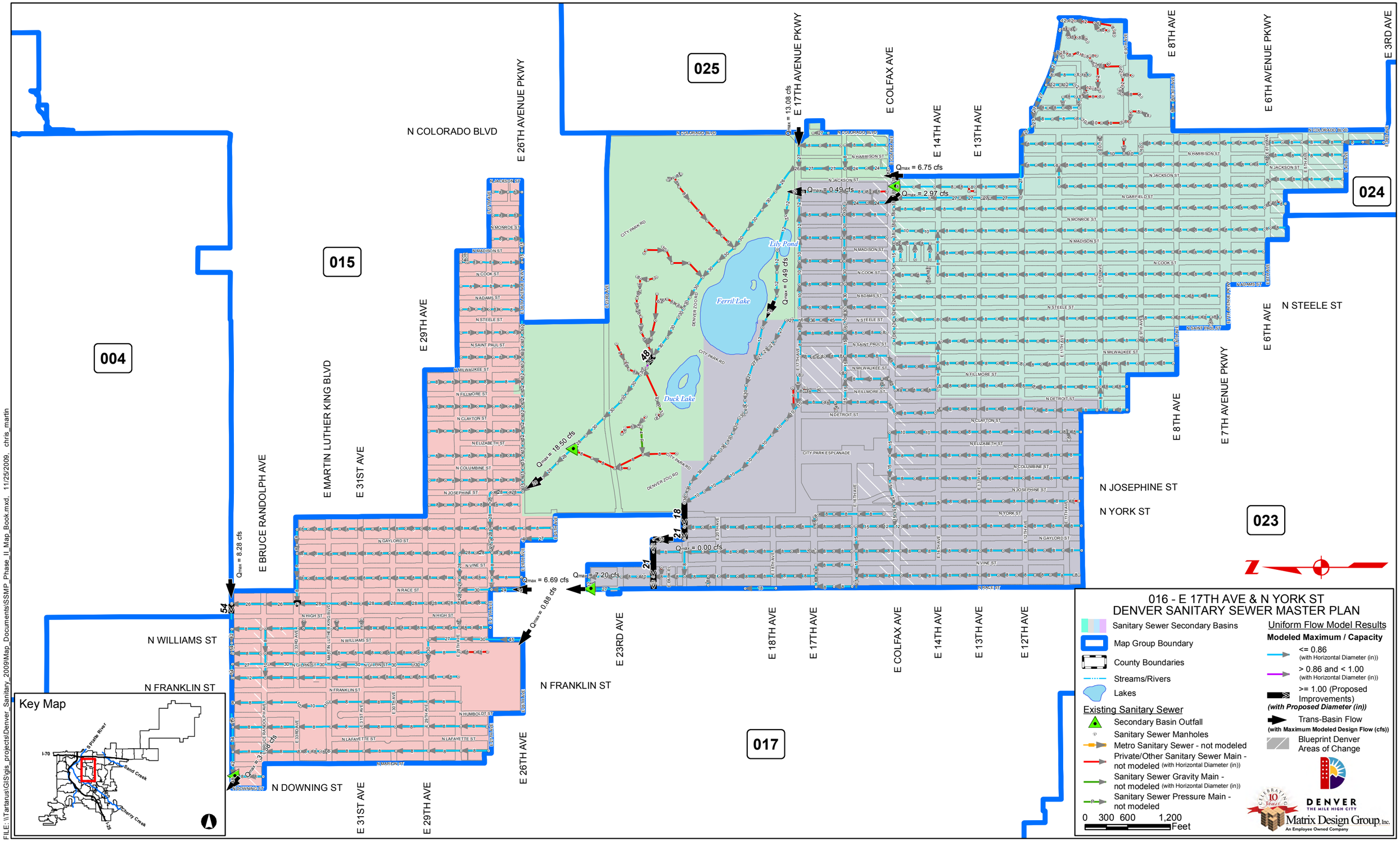
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
18" DIAMETER PVC PIPE	244	LF	$81	$19,764
18" DIAMETER PVC PIPE (JACK & BORE)	70	LF	$385	$26,950
21" DIAMETER PVC PIPE	1,099	LF	$92	$101,108
48" DIAMETER PVC PIPE	127	LF	$192	$24,384
54" DIAMETER PVC PIPE	130	LF	$216	$28,080
78" DIAMETER PVC PIPE	63	LF	$312	$19,656
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	6	EA	$3,040	$18,240
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	1	EA	$4,570	$4,570
TYPE B MANHOLE WITH TYPE A TOP SLAB	6	EA	$7,865	$47,190
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	16,182	SY-IN	$8	$129,458
WET UTILITY RELOCATE	1	EA		$34,775
DRY UTILITY RELOCATE			5%	$22,709
			SUBTOTAL	$476,884
TRAFFIC CONTROL			3%	$14,307
MOBILIZATION			10%	$47,688
ENGINEERING			15%	$71,533
MATERIALS MANAGEMENT			7%	$33,382
ADMINISTRATIVE			10%	$47,688
CONTINGENCY			25%	$119,221
			2008 ESTIMATED TOTAL COST	$810,703

Model Output Summary - Denver Owned Gravity Mains

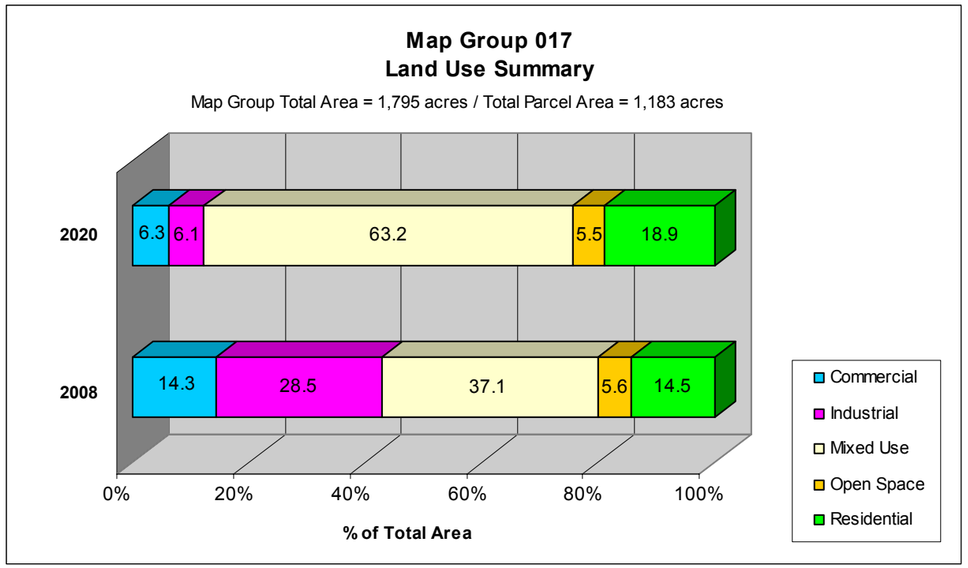
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	109	0.1
<= 0.86	206,700	99.1
> 0.86 & < 1	106	0.1
≥ 1 & < 2	1,356	0.6
≥ 2 & < 4	313	0.2
≥ 4	64	0.0
Total	208,649	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


016 - E 17TH AVE & N YORK ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
004
015
017
023
024
025
N COLORADO BLVD
E 26TH AVENUE PKWY
E 17TH AVENUE PKWY
E COLFAX AVE
E 14TH AVE
E 13TH AVE
E 8TH AVE
E 6TH AVENUE PKWY
E 3RD AVE
E 29TH AVE
E MARTIN LUTHER KING BLVD
E 31ST AVE
E BRUCE RANDOLPH AVE
N STEELE ST
E 6TH AVE
E 7TH AVENUE PKWY
N JOSEPHINE ST
N YORK ST
N WILLIAMS ST
N FRANKLIN ST
N DOWNING ST
E 23RD AVE
E 18TH AVE
E 17TH AVE
E 12TH AVE
E 26TH AVE
Lily Pond
Ferril Lake
Duck Lake
CITY PARK RD
CITY PARK ESPLANADE
DENVER ZOO RD
Qmax = 13.08 cfs
Qmax = 6.75 cfs
Qmax = 0.49 cfs
Qmax = 2.97 cfs
Qmax = 0.49 cfs
Qmax = 18.50 cfs
Qmax = 8.28 cfs
Qmax = 6.69 cfs
Qmax = 7.20 cfs
Qmax = 0.88 cfs
Qmax = 0.00 cfs
Qmax = 3.9 cfs
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 017 (E 23rd Ave & N Downing St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 017 COST ESTIMATE

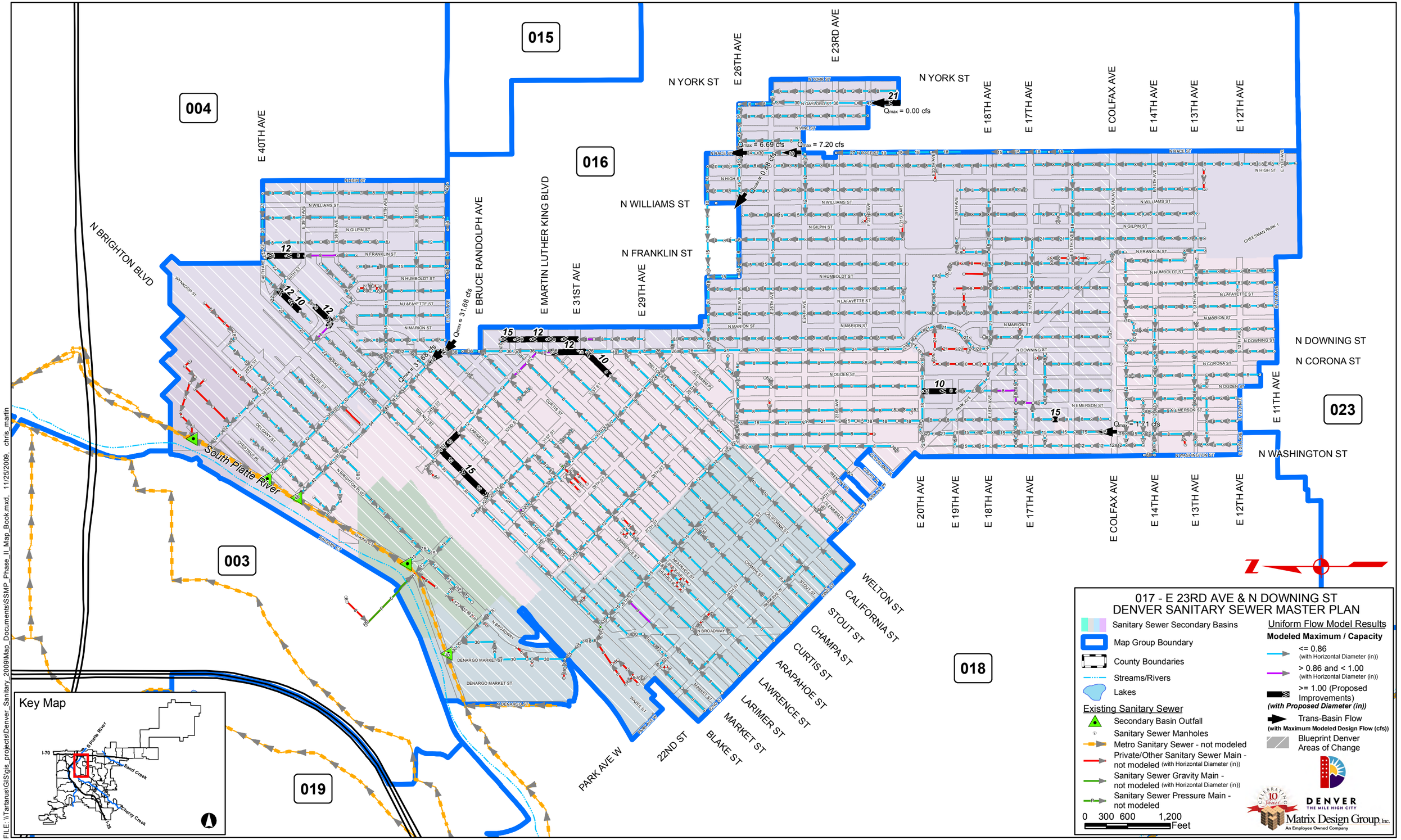
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	1,406	LF	$67	$94,202
12" DIAMETER PVC PIPE	2,286	LF	$71	$162,306
12" DIAMETER PVC PIPE (JACK & BORE)	54	LF	$257	$13,878
15" DIAMETER PVC PIPE	1,464	LF	$76	$111,264
15" DIAMETER PVC PIPE (JACK & BORE)	86	LF	$321	$27,606
21" DIAMETER PVC PIPE	208	LF	$92	$19,136
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	30	EA	$3,040	$91,200
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	48,564	SY-IN	$8	$388,509
WET UTILITY RELOCATE	1	EA		$89,345
DRY UTILITY RELOCATE			5%	$49,872
			SUBTOTAL	$1,047,318
TRAFFIC CONTROL			3%	$31,420
MOBILIZATION			10%	$104,732
ENGINEERING			15%	$157,098
MATERIALS MANAGEMENT			7%	$73,312
ADMINISTRATIVE			10%	$104,732
CONTINGENCY			25%	$261,830
			2008 ESTIMATED TOTAL COST	$1,780,442

Model Output Summary - Denver Owned Gravity Mains

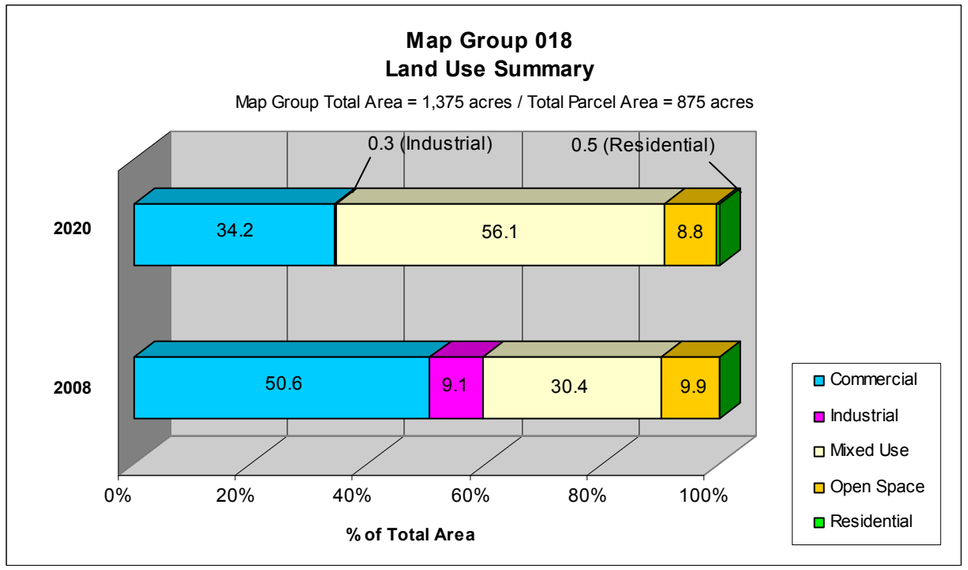
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	178	0.1
<= 0.86	249,676	96.6
> 0.86 & < 1	3,048	1.2
≥ 1 & < 2	5,010	1.9
≥ 2 & < 4	418	0.2
≥ 4	74	0.0
Total	258,404	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


017 - E 23RD AVE & N DOWNING ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
004
003
015
016
018
019
023
N YORK ST
E 26TH AVE
E 23RD AVE
E 18TH AVE
E 17TH AVE
E COLFAX AVE
E 14TH AVE
E 13TH AVE
E 12TH AVE
E 40TH AVE
N BRIGHTON BLVD
N WILLIAMS ST
N FRANKLIN ST
E BRUCE RANDOLPH AVE
E MARTIN LUTHER KING BLVD
E 31ST AVE
E 29TH AVE
N DOWNING ST
N CORONA ST
E 11TH AVE
N WASHINGTON ST
E 20TH AVE
E 19TH AVE
WELTON ST
CALIFORNIA ST
STOUT ST
CHAMPA ST
CURTIS ST
ARAPAHOE ST
LAWRENCE ST
LARIMER ST
MARKET ST
BLAKE ST
22ND ST
PARK AVE W
South Platte River
Qmax = 0.00 cfs
Qmax = 6.69 cfs
Qmax = 7.20 cfs
Qmax = 0.88 cfs
Qmax = 31.68 cfs
Qmax = 1.71 cfs
CHEESMAN PARK 1
DENARGO MARKET ST
N BROADWAY
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 018 (Colfax Ave & N Broadway)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

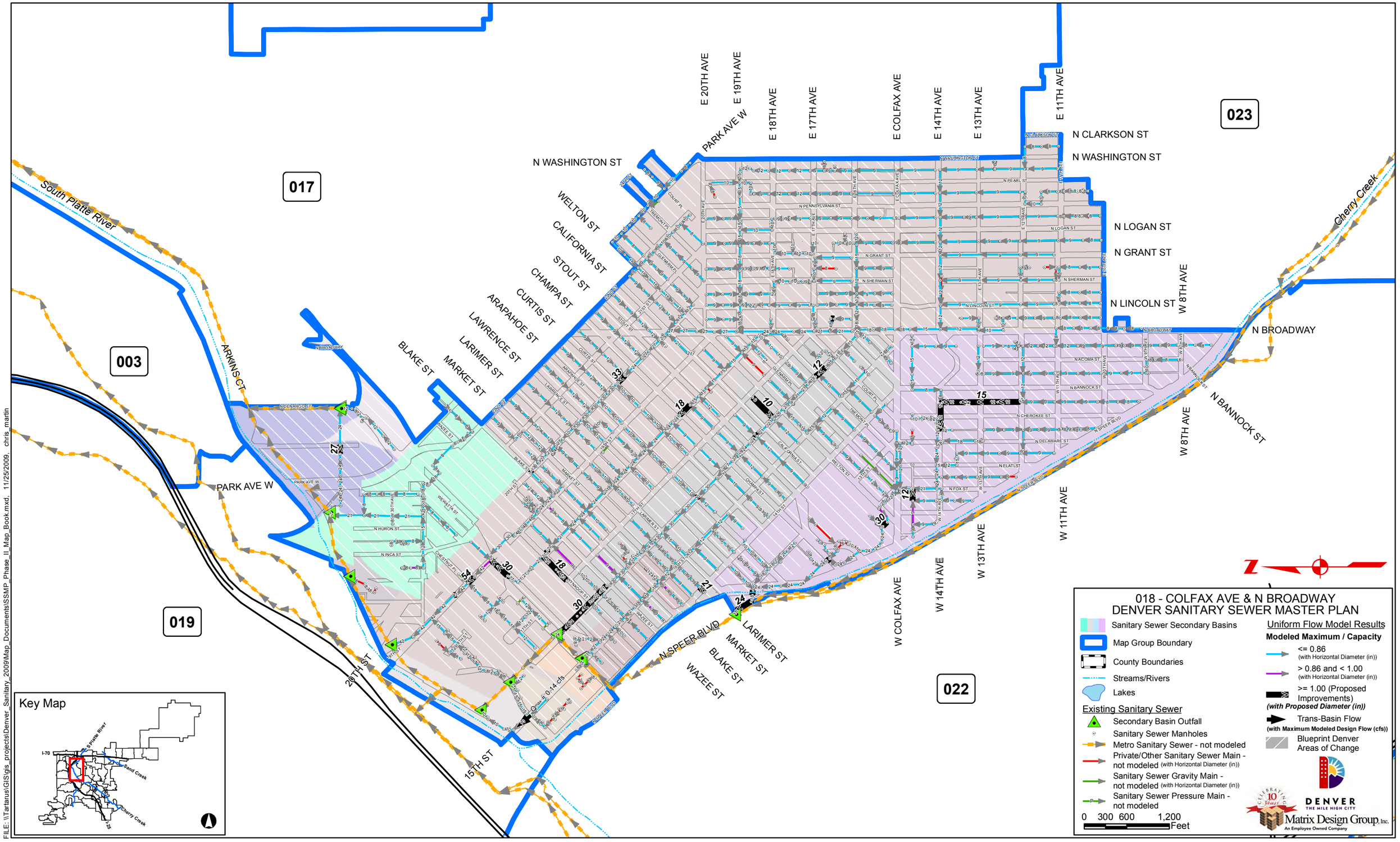
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	2,111	1.2
<= 0.86	168,370	94.2
> 0.86 & < 1	2,789	1.6
≥ 1 & < 2	5,283	3.0
≥ 2 & < 4	83	0.0
≥ 4	130	0.1
Total	178,765	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 018 COST ESTIMATE

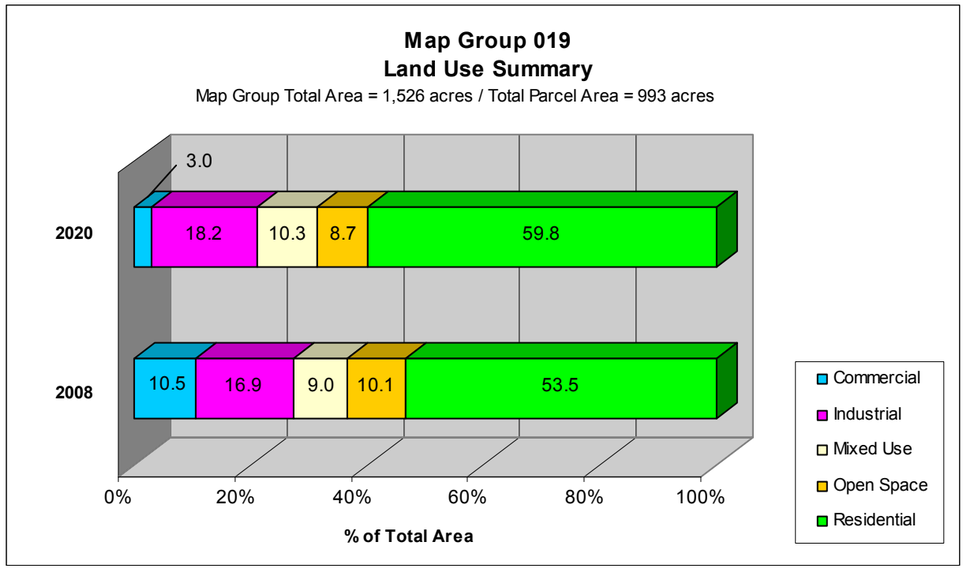
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	433	LF	$67	$29,011
12" DIAMETER PVC PIPE	308	LF	$71	$21,868
15" DIAMETER PVC PIPE	1,505	LF	$76	$114,380
15" DIAMETER PVC PIPE (JACK & BORE)	60	LF	$321	$19,260
18" DIAMETER PVC PIPE	683	LF	$81	$55,323
21" DIAMETER PVC PIPE	99	LF	$92	$9,108
21" DIAMETER PVC PIPE (JACK & BORE)	60	LF	$449	$26,940
24" DIAMETER PVC PIPE	454	LF	$102	$46,308
27" DIAMETER PVC PIPE	95	LF	$108	$10,260
27" DIAMETER PVC PIPE (JACK & BORE)	31	LF	$578	$17,918
30" DIAMETER PVC PIPE	1,159	LF	$120	$139,080
30" DIAMETER PVC PIPE (JACK & BORE)	105	LF	$642	$67,410
33" DIAMETER PVC PIPE	289	LF	$132	$38,148
42" DIAMETER PVC PIPE	26	LF	$168	$4,368
48" DIAMETER PVC PIPE	43	LF	$192	$8,256
54" DIAMETER PVC PIPE	116	LF	$216	$25,056
72" DIAMETER PVC PIPE	29	LF	$288	$8,352
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	40	EA	$3,040	$121,600
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	21	EA	$4,570	$95,970
TYPE B MANHOLE WITH TYPE A TOP SLAB	9	EA	$7,865	$70,785
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	51,027	SY-IN	$8	$408,215
WET UTILITY RELOCATE	1	EA		$119,305
DRY UTILITY RELOCATE			5%	$72,846
			SUBTOTAL	$1,529,767
TRAFFIC CONTROL			3%	$45,893
MOBILIZATION			10%	$152,977
ENGINEERING			15%	$229,465
MATERIALS MANAGEMENT			7%	$107,084
ADMINISTRATIVE			10%	$152,977
CONTINGENCY			25%	$382,442
			2008 ESTIMATED TOTAL COST	$2,600,605


018 - COLFAX AVE & N BROADWAY
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
I-70
South Platte River
Sand Creek
Cherry Creek
Lake
017
003
019
022
023
South Platte River
Cherry Creek
N WASHINGTON ST
WELTON ST
CALIFORNIA ST
STOUT ST
CHAMPA ST
CURTIS ST
ARAPAHOE ST
LAWRENCE ST
LARIMER ST
MARKET ST
BLAKE ST
WAZEE ST
N SPEER BLVD
PARK AVE W
ARKINS CT
20TH ST
15TH ST
E 20TH AVE
E 19TH AVE
E 18TH AVE
E 17TH AVE
E COLFAX AVE
E 14TH AVE
E 13TH AVE
E 11TH AVE
N CLARKSON ST
N WASHINGTON ST
N LOGAN ST
N GRANT ST
N LINCOLN ST
W 8TH AVE
N BROADWAY
N BANNOCK ST
W 8TH AVE
W 11TH AVE
W 13TH AVE
W 14TH AVE
W COLFAX AVE

Map Group 019 (W 38th Ave & N Pecos St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 019 COST ESTIMATE

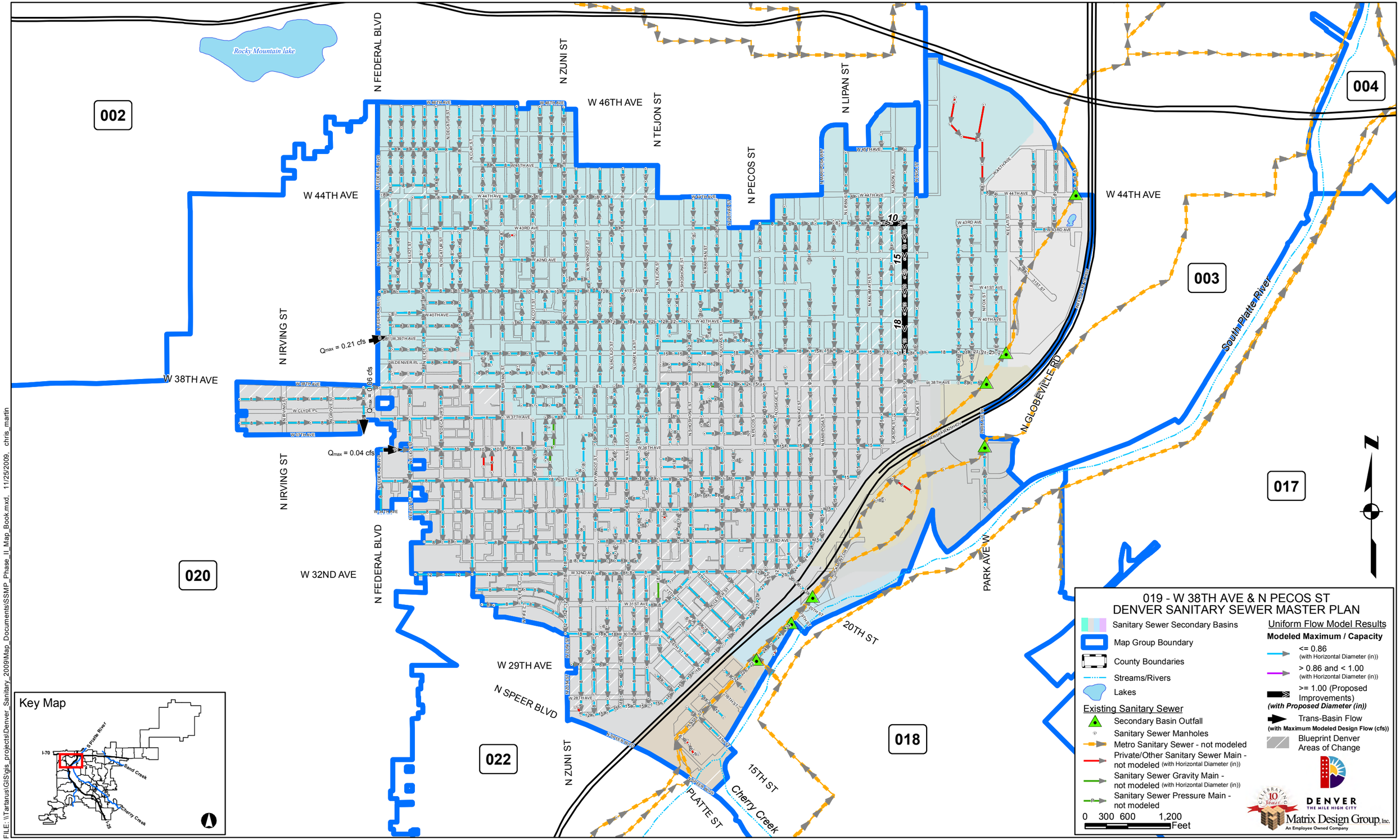
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	335	LF	$67	$22,445
15" DIAMETER PVC PIPE	1,024	LF	$76	$77,824
18" DIAMETER PVC PIPE	809	LF	$81	$65,529
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	11	EA	$3,040	$33,440
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	20,117	SY-IN	$8	$160,933
WET UTILITY RELOCATE	1	EA		$13,910
DRY UTILITY RELOCATE			5%	$18,704
			SUBTOTAL	$392,785
TRAFFIC CONTROL			3%	$11,784
MOBILIZATION			10%	$39,278
ENGINEERING			15%	$58,918
MATERIALS MANAGEMENT			7%	$27,495
ADMINISTRATIVE			10%	$39,278
CONTINGENCY			25%	$98,196
	2008 ESTIMATED TOTAL COST			$667,734

Model Output Summary - Denver Owned Gravity Mains

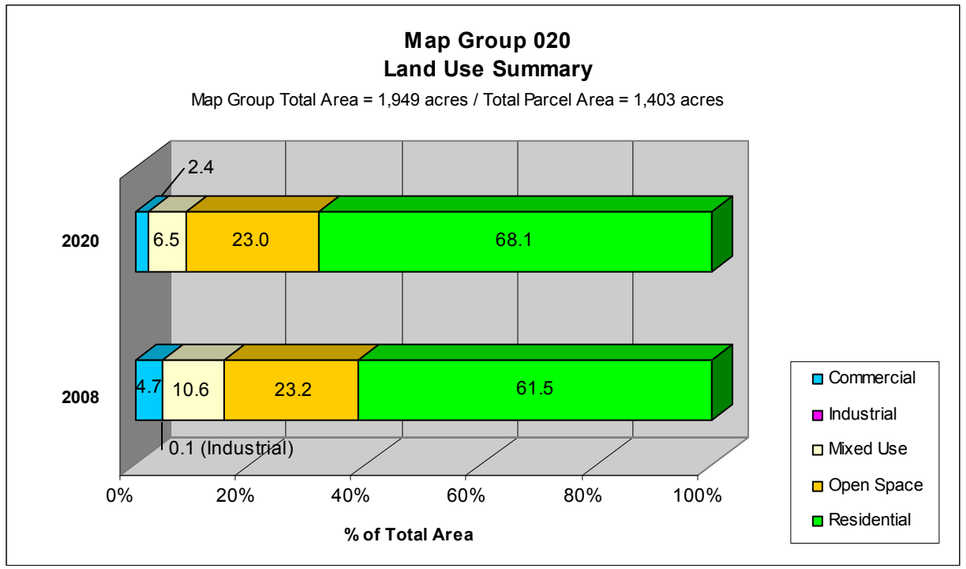
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	1,570	0.6
<= 0.86	239,953	98.5
> 0.86 & < 1	0	0.0
≥ 1 & < 2	844	0.3
≥ 2 & < 4	1,323	0.5
≥ 4	0	0.0
Total	243,690	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


019 - W 38TH AVE & N PECOS ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
Rocky Mountain lake
N FEDERAL BLVD
N ZUNI ST
W 46TH AVE
N TEJON ST
N PECOS ST
N LIPAN ST
W 44TH AVE
N IRVING ST
W 38TH AVE
W 32ND AVE
W 29TH AVE
N SPEER BLVD
N ZUNI ST
PLATTE ST
Cherry Creek
15TH ST
20TH ST
PARK AVE W
N GLOBEVILLE RD
South Platte River
Qmax = 0.21 cfs
Qmax = 0.06 cfs
Qmax = 0.04 cfs
002
003
004
017
018
020
022
10
15
18
I-70
South Platte River
Sand Creek
Cherry Creek
I-25

Map Group 020 (W 26th Ave & N Federal Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 020 COST ESTIMATE

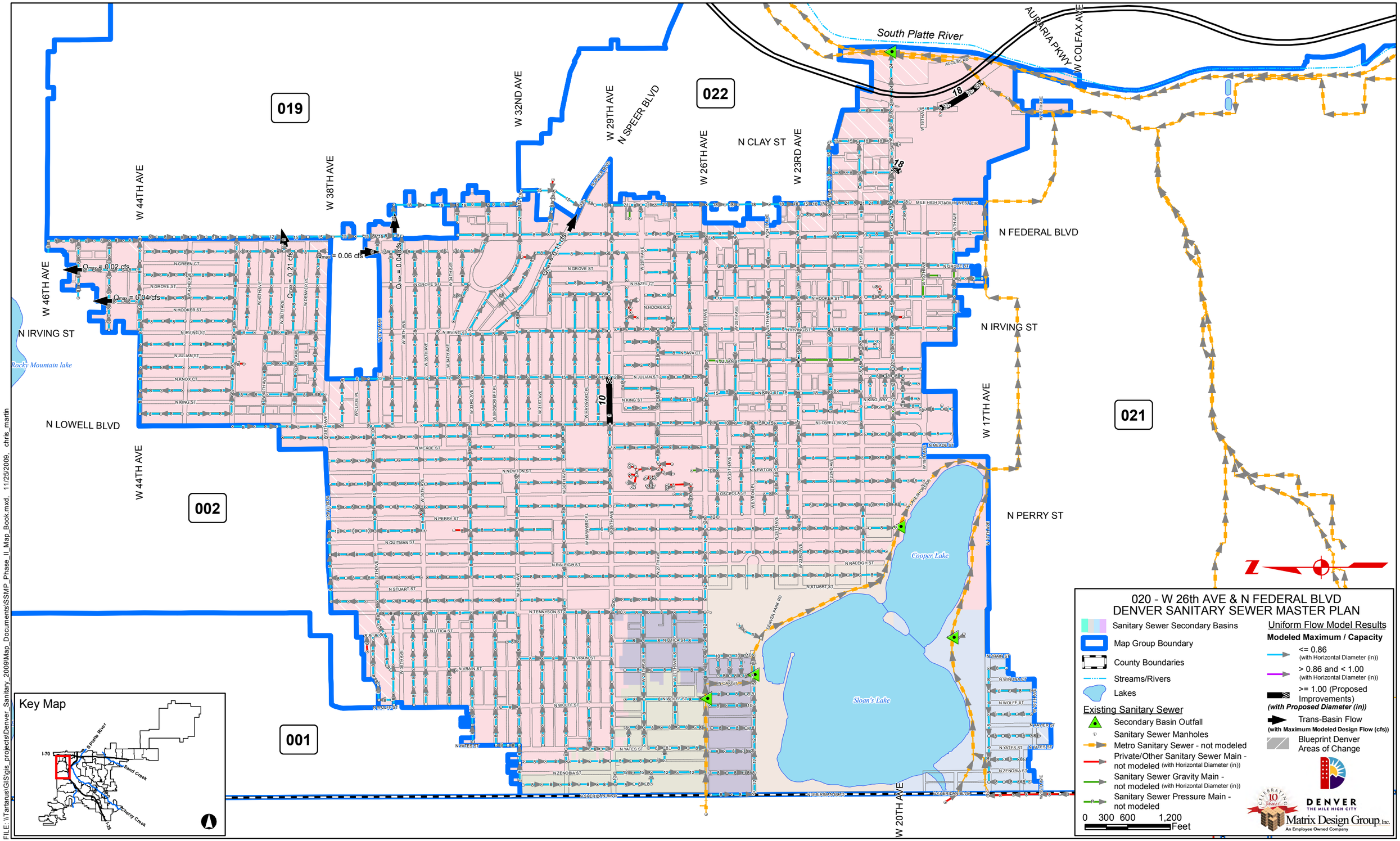
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	655	LF	$67	$43,885
15" DIAMETER PVC PIPE	12	LF	$76	$912
18" DIAMETER PVC PIPE	823	LF	$81	$66,663
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	9	EA	$3,040	$27,360
TYPE B MANHOLE WITH TYPE A TOP SLAB	1	EA	$7,865	$7,865
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	13,715	SY-IN	$8	$109,723
WET UTILITY RELOCATE	1	EA		$16,585
DRY UTILITY RELOCATE			5%	$13,650
			SUBTOTAL	$286,643
TRAFFIC CONTROL			3%	$8,599
MOBILIZATION			10%	$28,664
ENGINEERING			15%	$42,996
MATERIALS MANAGEMENT			7%	$20,065
ADMINISTRATIVE			10%	$28,664
CONTINGENCY			25%	$71,661
	2008 ESTIMATED TOTAL COST			$487,292

Model Output Summary - Denver Owned Gravity Mains

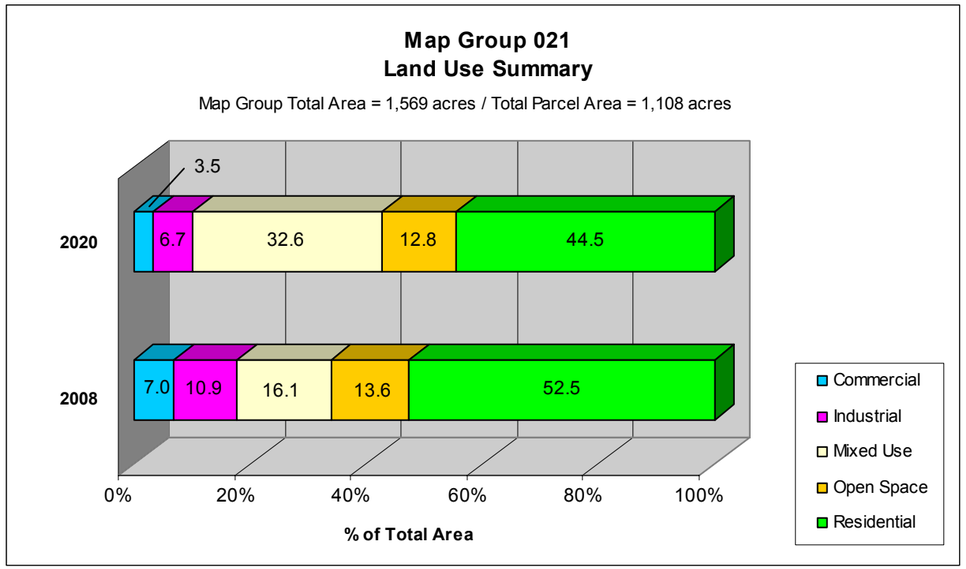
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	2,902	1.0
<= 0.86	287,684	98.5
> 0.86 & < 1	0	0.0
≥ 1 & < 2	668	0.2
≥ 2 & < 4	701	0.2
≥ 4	122	0.0
Total	292,076	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


020 - W 26th AVE & N FEDERAL BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
South Platte River
Rocky Mountain lake
Cooper Lake
Sloan's Lake
019
022
021
002
001
W 44TH AVE
W 46TH AVE
W 38TH AVE
W 32ND AVE
W 29TH AVE
N SPEER BLVD
W 26TH AVE
N CLAY ST
W 23RD AVE
N FEDERAL BLVD
N IRVING ST
N LOWELL BLVD
W 17TH AVE
N PERRY ST
W 20TH AVE
AURARIA PKWY
W COLFAX AVE
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 021 (W Colfax Ave & N Federal Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 021 COST ESTIMATE

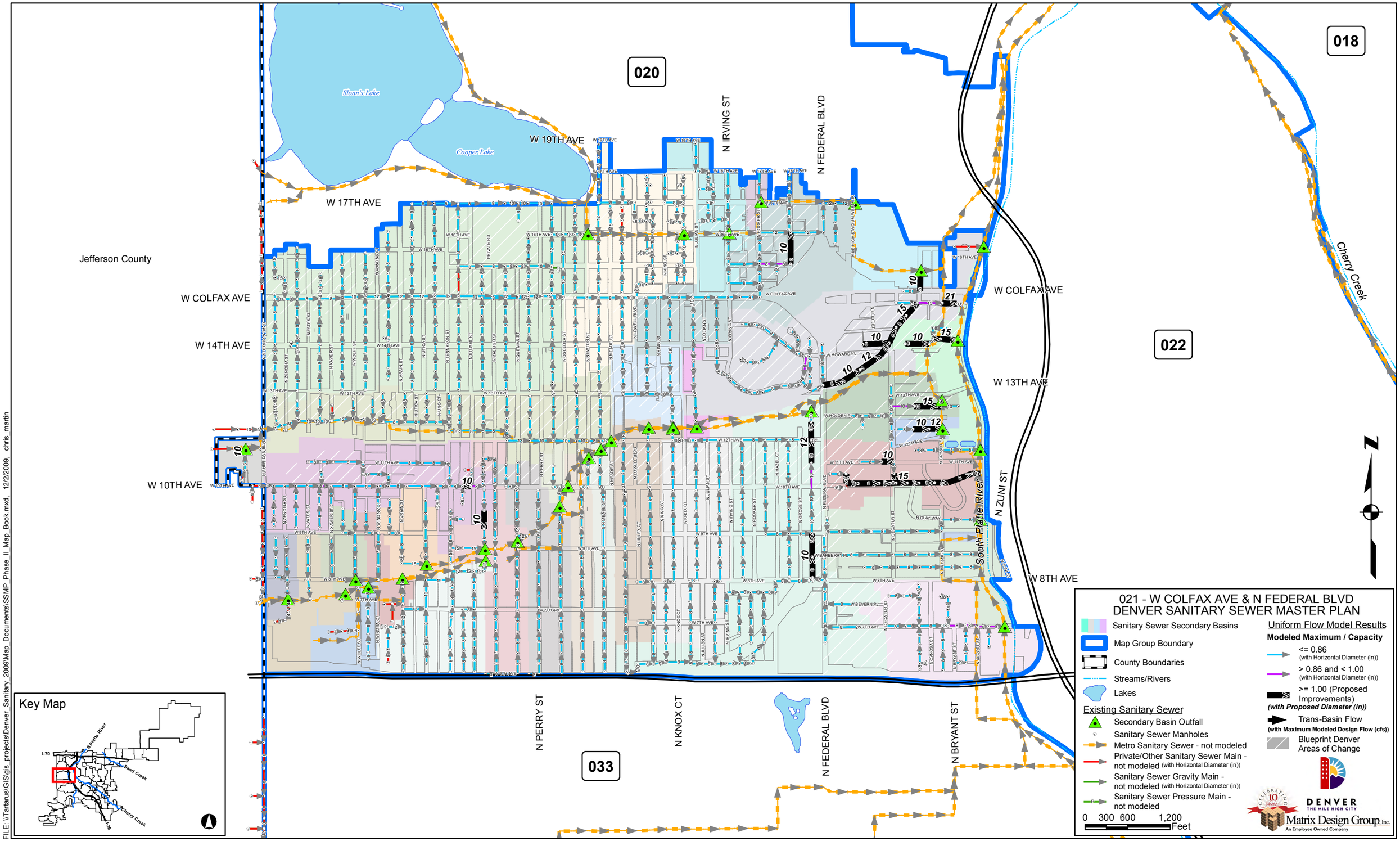
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	3,627	LF	$67	$243,009
12" DIAMETER PVC PIPE	1,255	LF	$71	$89,105
12" DIAMETER PVC PIPE (JACK & BORE)	76	LF	$257	$19,532
15" DIAMETER PVC PIPE	3,458	LF	$76	$262,808
15" DIAMETER PVC PIPE (JACK & BORE)	50	LF	$321	$16,050
21" DIAMETER PVC PIPE	204	LF	$92	$18,768
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	51	EA	$3,040	$155,040
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	1	EA	$4,570	$4,570
TYPE B MANHOLE WITH TYPE A TOP SLAB	4	EA	$7,865	$31,460
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	77,309	SY-IN	$8	$618,472
WET UTILITY RELOCATE	1	EA		$51,895
DRY UTILITY RELOCATE			5%	$75,535
			SUBTOTAL	$1,586,244
TRAFFIC CONTROL			3%	$47,587
MOBILIZATION			10%	$158,624
ENGINEERING			15%	$237,937
MATERIALS MANAGEMENT			7%	$111,037
ADMINISTRATIVE			10%	$158,624
CONTINGENCY			25%	$396,561
			2008 ESTIMATED TOTAL COST	$2,696,614

Model Output Summary - Denver Owned Gravity Mains

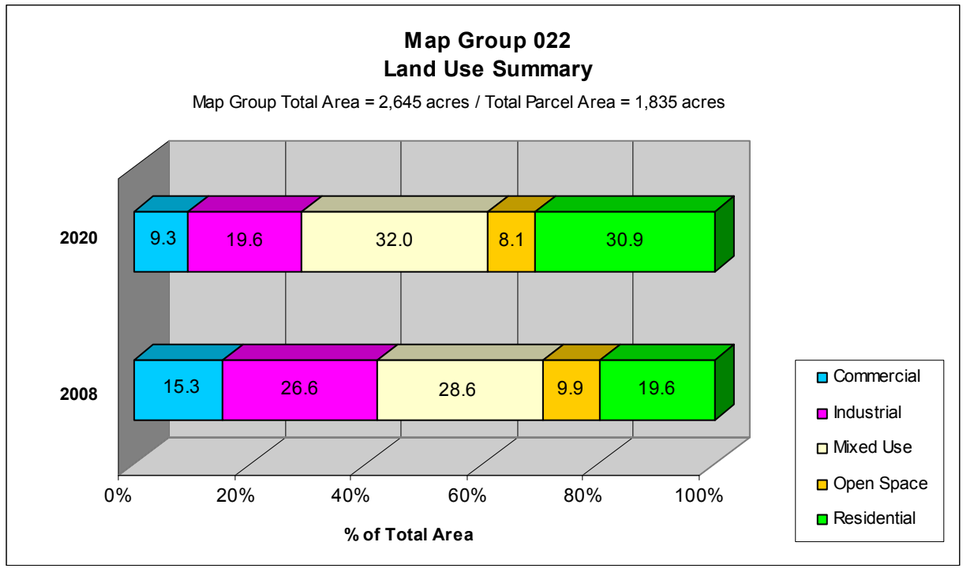
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	180	0.1
<= 0.86	185,730	94.0
> 0.86 & < 1	3,051	1.5
≥ 1 & < 2	5,299	2.7
≥ 2 & < 4	2,910	1.5
≥ 4	460	0.2
Total	197,630	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


021 - W COLFAX AVE & N FEDERAL BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
Sloan's Lake
Cooper Lake
Jefferson County
W 19TH AVE
W 17TH AVE
W COLFAX AVE
W 14TH AVE
W 10TH AVE
W 8TH AVE
W 13TH AVE
N IRVING ST
N FEDERAL BLVD
N PERRY ST
N KNOX CT
N BRYANT ST
N ZUNI ST
South Platte River
Cherry Creek
020
018
022
033
I-70
Sand Creek
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 12/2/2009, chris_martin

Map Group 022 (Auraria Pkwy & N Speer Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 022 COST ESTIMATE

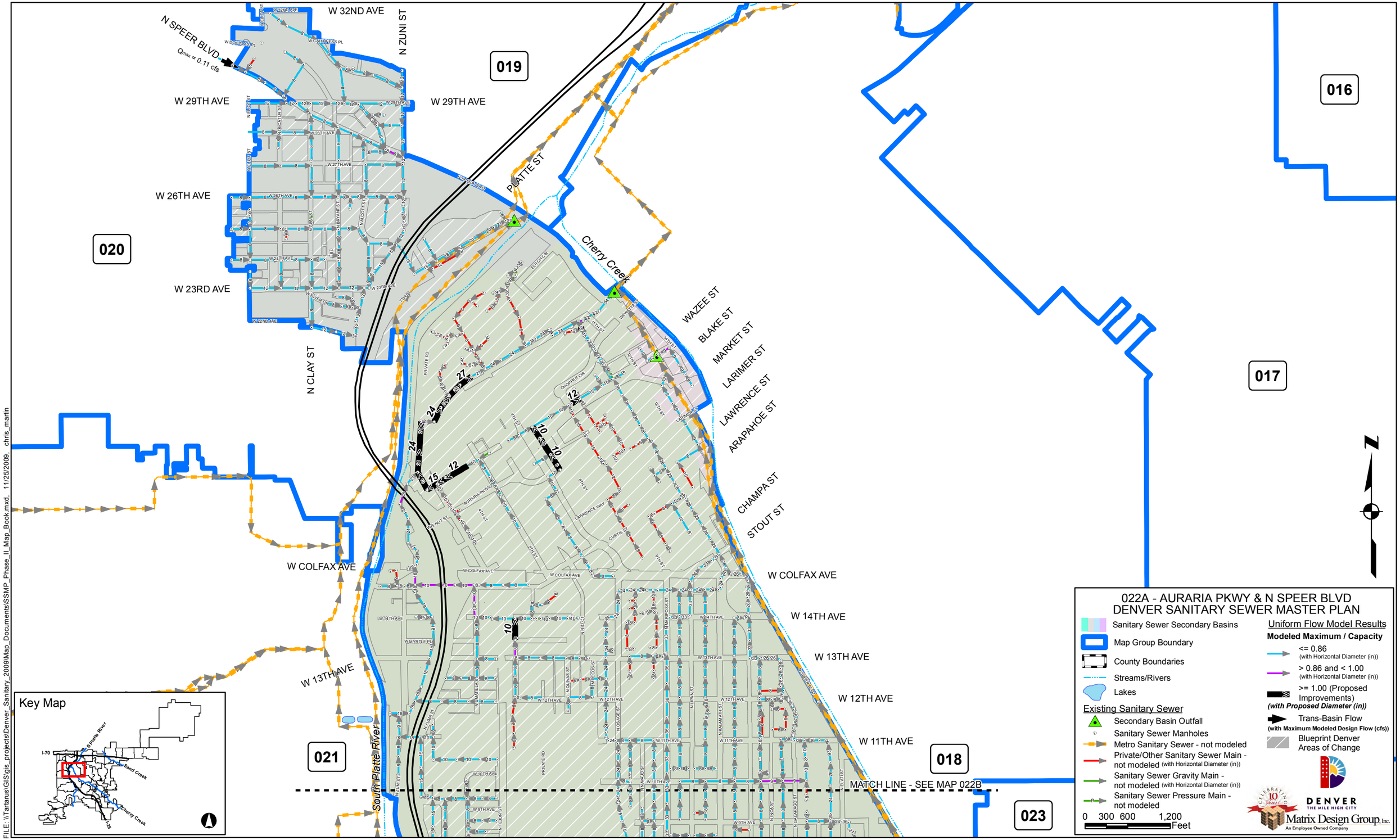
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	1,004	LF	$67	$67,268
12" DIAMETER PVC PIPE	495	LF	$71	$35,145
15" DIAMETER PVC PIPE	328	LF	$76	$24,928
18" DIAMETER PVC PIPE	281	LF	$81	$22,761
24" DIAMETER PVC PIPE	1,357	LF	$102	$138,414
27" DIAMETER PVC PIPE	247	LF	$108	$26,676
36" DIAMETER PVC PIPE	188	LF	$144	$27,072
42" DIAMETER PVC PIPE	31	LF	$168	$5,208
66" DIAMETER PVC PIPE	129	LF	$264	$34,056
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	24	EA	$3,040	$72,960
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	5	EA	$4,570	$22,850
TYPE B MANHOLE WITH TYPE A TOP SLAB	8	EA	$7,865	$62,920
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	37,553	SY-IN	$8	$300,427
WET UTILITY RELOCATE	1	EA		$46,545
DRY UTILITY RELOCATE			5%	$44,362
			SUBTOTAL	$931,592
TRAFFIC CONTROL			3%	$27,948
MOBILIZATION			10%	$93,159
ENGINEERING			15%	$139,739
MATERIALS MANAGEMENT			7%	$65,211
ADMINISTRATIVE			10%	$93,159
CONTINGENCY			25%	$232,898
			2008 ESTIMATED TOTAL COST	$1,583,706

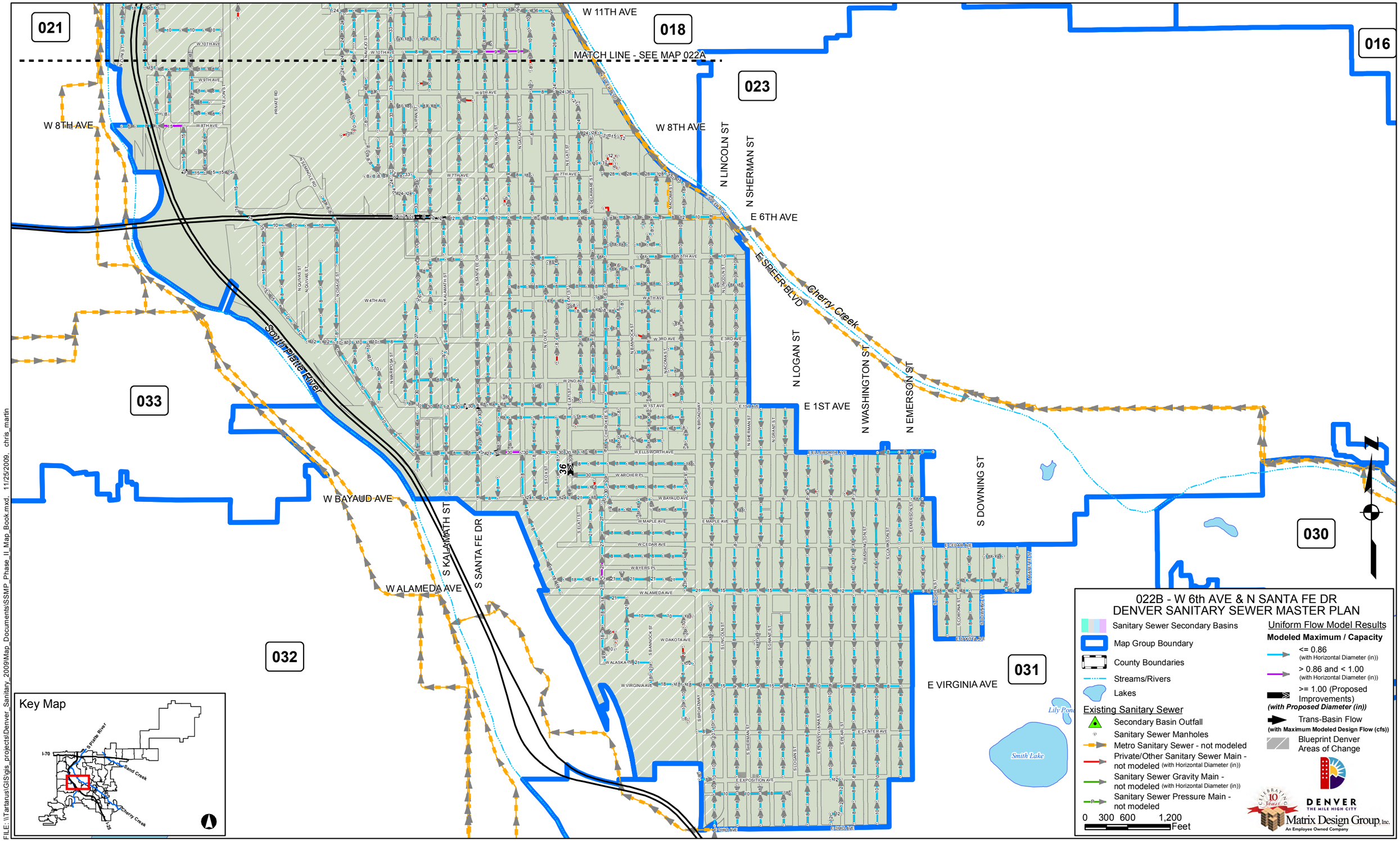
Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	1,352	0.4
<= 0.86	299,046	96.8
> 0.86 & < 1	4,613	1.5
≥ 1 & < 2	3,378	1.1
≥ 2 & < 4	521	0.2
≥ 4	161	0.1
Total	309,070	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

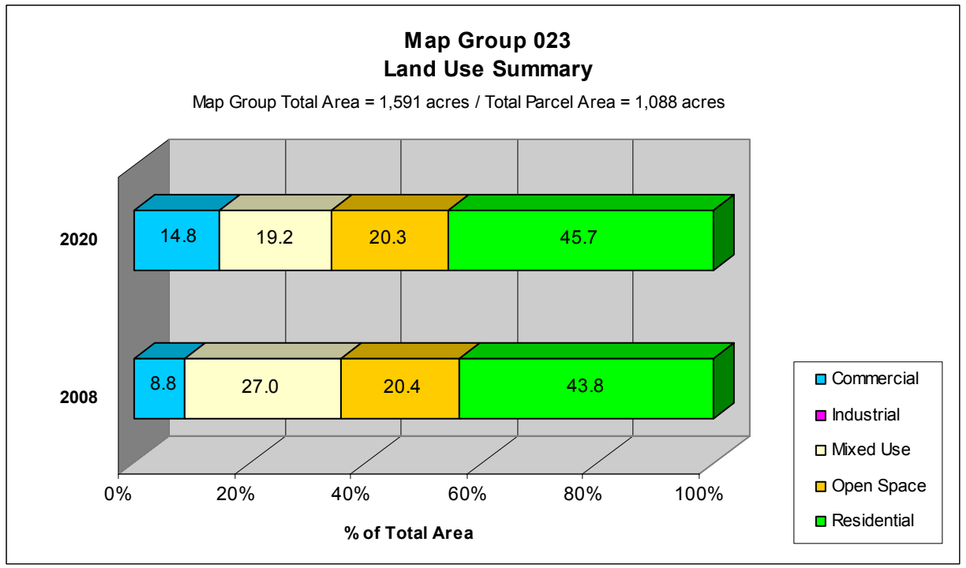

022A - AURARIA PKWY & N SPEER BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
N SPEER BLVD
Qmax = 0.11 cfs
W 32ND AVE
N ZUNI ST
W 29TH AVE
W 26TH AVE
W 23RD AVE
N CLAY ST
W COLFAX AVE
W 13TH AVE
W 14TH AVE
W 12TH AVE
W 11TH AVE
PLATTE ST
Cherry Creek
WAZEE ST
BLAKE ST
MARKET ST
LARIMER ST
LAWRENCE ST
ARAPAHOE ST
CHAMPA ST
STOUT ST
South Platte River
MATCH LINE - SEE MAP 022B
016
017
018
019
020
021
023
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

This page intentionally blank


022B - W 6th AVE & N SANTA FE DR
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
I-25
021
018
016
023
033
036
030
032
031
MATCH LINE - SEE MAP 022A
W 11TH AVE
W 8TH AVE
N LINCOLN ST
N SHERMAN ST
E 6TH AVE
E SPEER BLVD
Cherry Creek
N LOGAN ST
N WASHINGTON ST
N EMERSON ST
E 1ST AVE
S DOWNING ST
South Platte River
W BAYAUD AVE
W ALAMEDA AVE
S KALAMATH ST
S SANTA FE DR
E VIRGINIA AVE
Smith Lake
Lily Pond
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009, chris_martin

Map Group 023 (E 1st Ave & N University Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 023 COST ESTIMATE

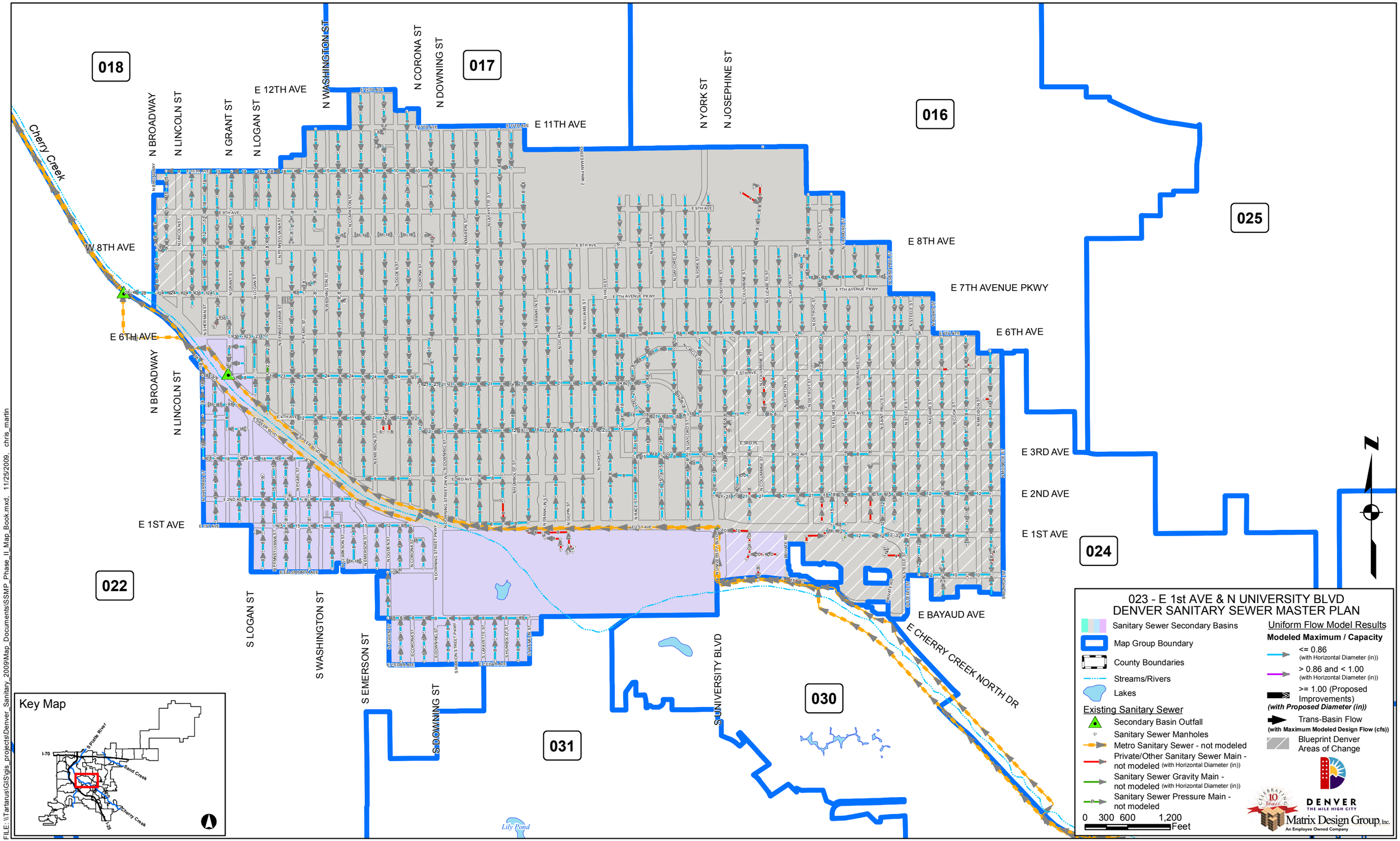
SANITARY SEWER IMPROVEMENTS

2008 ESTIMATED TOTAL COST	$0

Model Output Summary - Denver Owned Gravity Mains

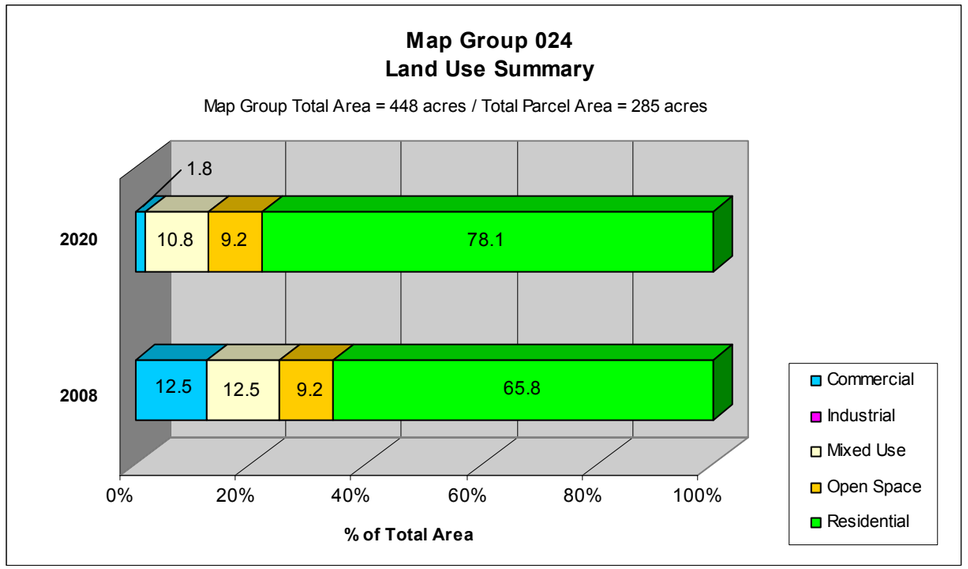
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	498	0.2
<= 0.86	215,212	99.8
> 0.86 & < 1	0	0.0
≥ 1 & < 2	14	0.0
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	215,724	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


023 - E 1st AVE & N UNIVERSITY BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
Matrix Design Group, Inc.
An Employee Owned Company
DENVER THE MILE HIGH CITY
Key Map
018
017
016
025
024
022
031
030
Cherry Creek
W 8TH AVE
E 6TH AVE
E 1ST AVE
N BROADWAY
N LINCOLN ST
N GRANT ST
N LOGAN ST
E 12TH AVE
N WASHINGTON ST
N CORONA ST
N DOWNING ST
E 11TH AVE
N YORK ST
N JOSEPHINE ST
E 8TH AVE
E 7TH AVENUE PKWY
E 6TH AVE
E 3RD AVE
E 2ND AVE
E 1ST AVE
S LOGAN ST
S WASHINGTON ST
S EMERSON ST
S DOWNING ST
S UNIVERSITY BLVD
E BAYAUD AVE
E CHERRY CREEK NORTH DR
Lily Pond
N

Map Group 024 (E Alameda Ave & S Colorado Blvd)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

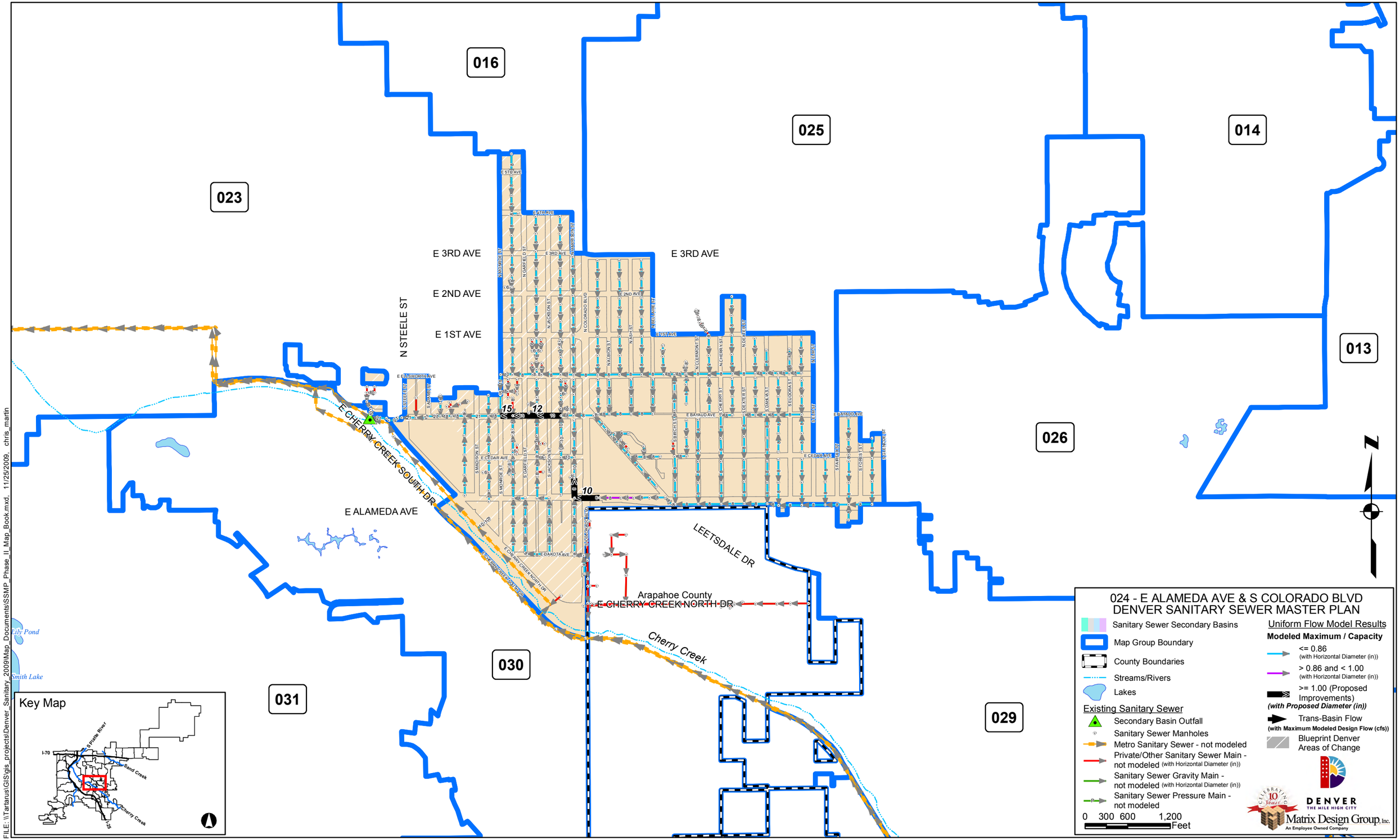
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	4	0.0
<= 0.86	62,738	96.8
> 0.86 & < 1	562	0.9
≥ 1 & < 2	1,485	2.3
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	64,789	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 024 COST ESTIMATE

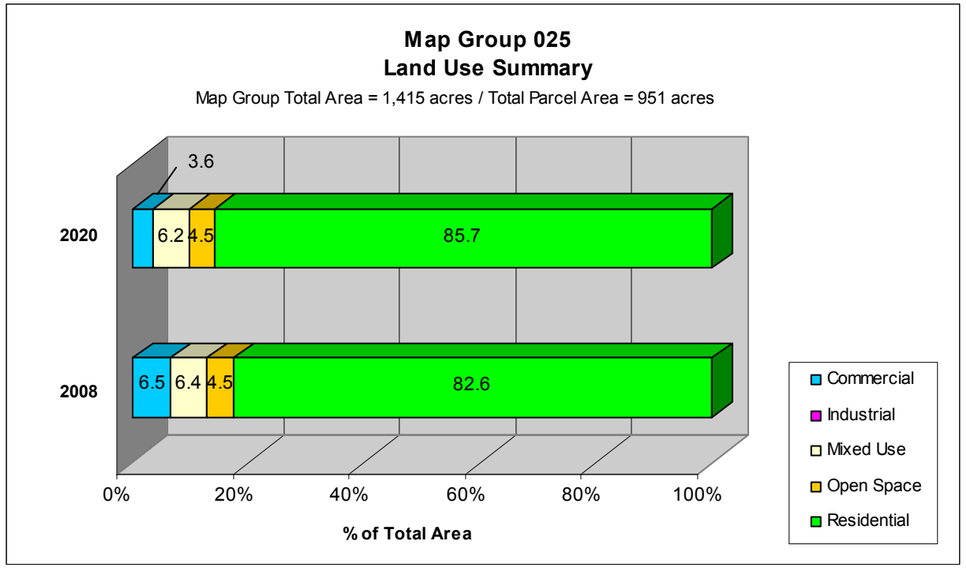
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	563	LF	$67	$37,721
10" DIAMETER PVC PIPE (JACK & BORE)	66	LF	$214	$14,124
12" DIAMETER PVC PIPE	680	LF	$71	$48,280
15" DIAMETER PVC PIPE	175	LF	$76	$13,300
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	7	EA	$3,040	$21,280
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	12,712	SY-IN	$8	$101,695
WET UTILITY RELOCATE	1	EA		$18,725
DRY UTILITY RELOCATE			5%	$12,756
			SUBTOTAL	$267,881
TRAFFIC CONTROL			3%	$8,036
MOBILIZATION			10%	$26,788
ENGINEERING			15%	$40,182
MATERIALS MANAGEMENT			7%	$18,752
ADMINISTRATIVE			10%	$26,788
CONTINGENCY			25%	$66,970
	2008 ESTIMATED TOTAL COST			$455,397


016
025
014
023
013
026
030
031
029
E 3RD AVE
E 2ND AVE
E 1ST AVE
N STEELE ST
E CHERRY CREEK SOUTH DR
E ALAMEDA AVE
LEETSDALE DR
Arapahoe County
E CHERRY CREEK NORTH DR
Cherry Creek
Lily Pond
Smith Lake
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
I-25
024 - E ALAMEDA AVE & S COLORADO BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER
THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 025 (E 13th Ave & N Colorado Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 025 COST ESTIMATE

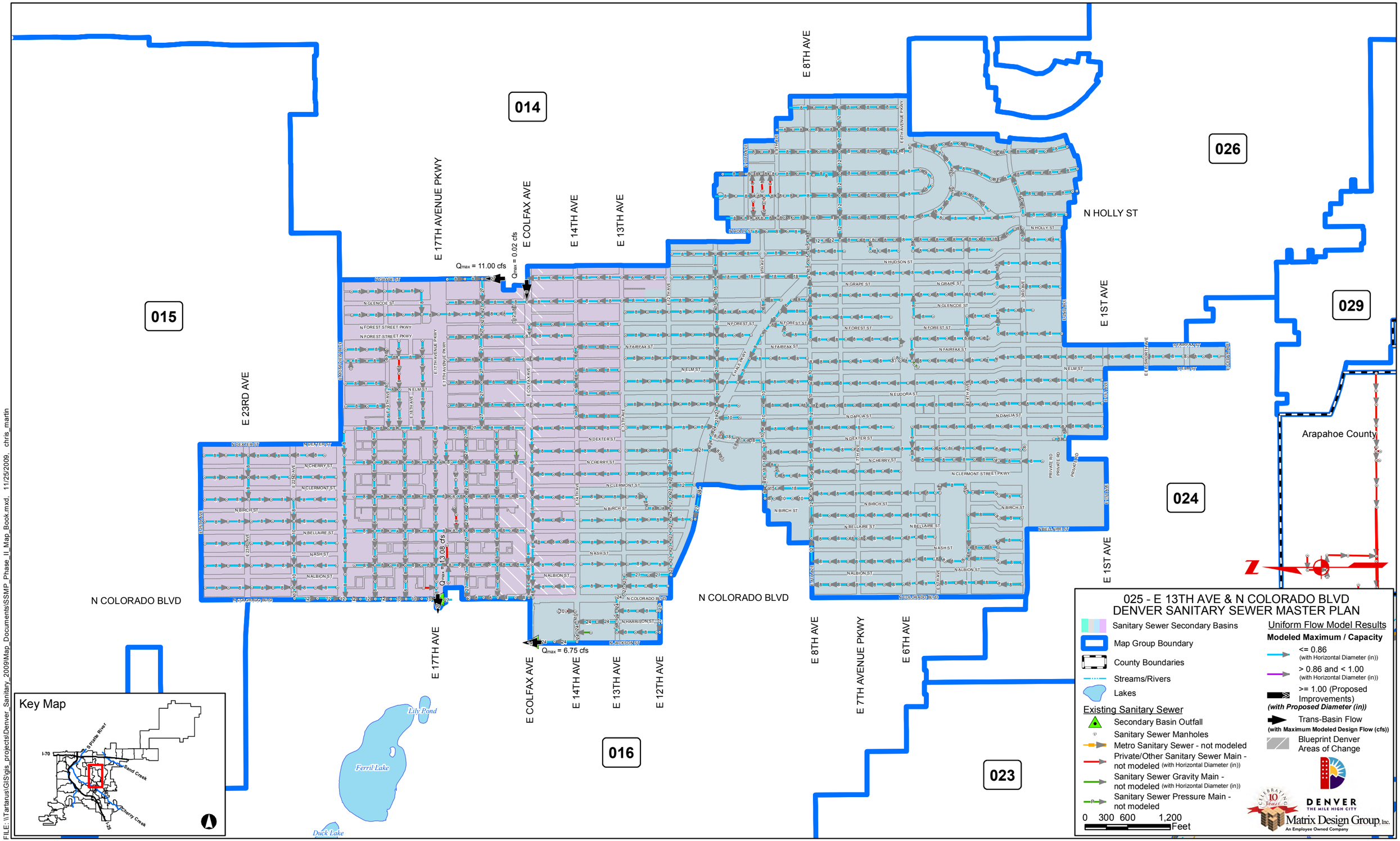
SANITARY SEWER IMPROVEMENTS

2008 ESTIMATED TOTAL COST	$0

Model Output Summary - Denver Owned Gravity Mains

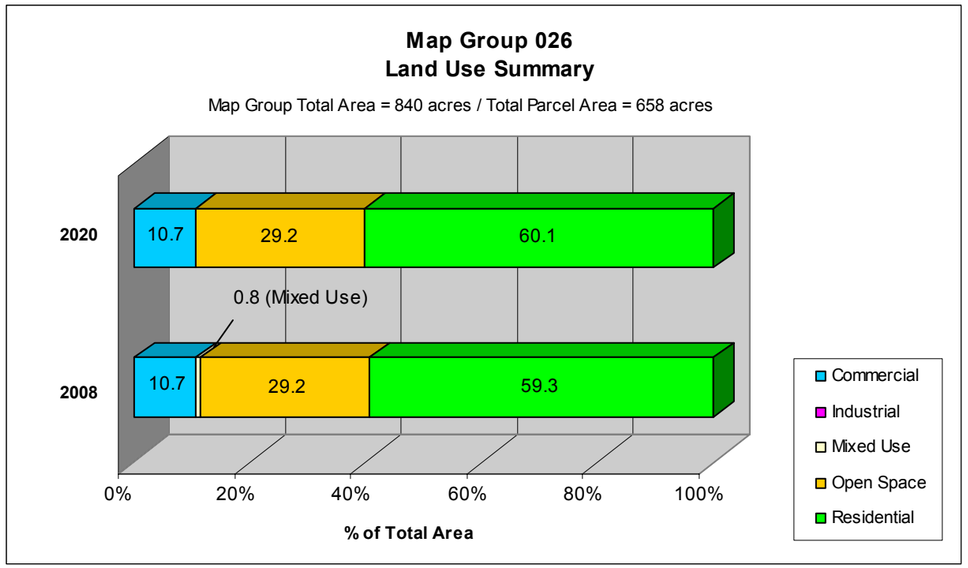
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	773	0.3
<= 0.86	220,801	99.7
> 0.86 & < 1	0	0.0
≥ 1 & < 2	0	0.0
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	221,574	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


025 - E 13TH AVE & N COLORADO BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
014
015
016
023
024
026
029
Arapahoe County
E 17TH AVENUE PKWY
E COLFAX AVE
E 14TH AVE
E 13TH AVE
E 12TH AVE
E 8TH AVE
E 7TH AVENUE PKWY
E 6TH AVE
E 1ST AVE
E 23RD AVE
N HOLLY ST
N COLORADO BLVD
Qmax = 11.00 cfs
Qmax = 0.02 cfs
Qmax = 3.08 cfs
Qmax = 6.75 cfs
Lily Pond
Ferril Lake
Duck Lake
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_marlin

Map Group 026 (E Alameda Ave & S Monaco Street Pkwy)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 026 COST ESTIMATE

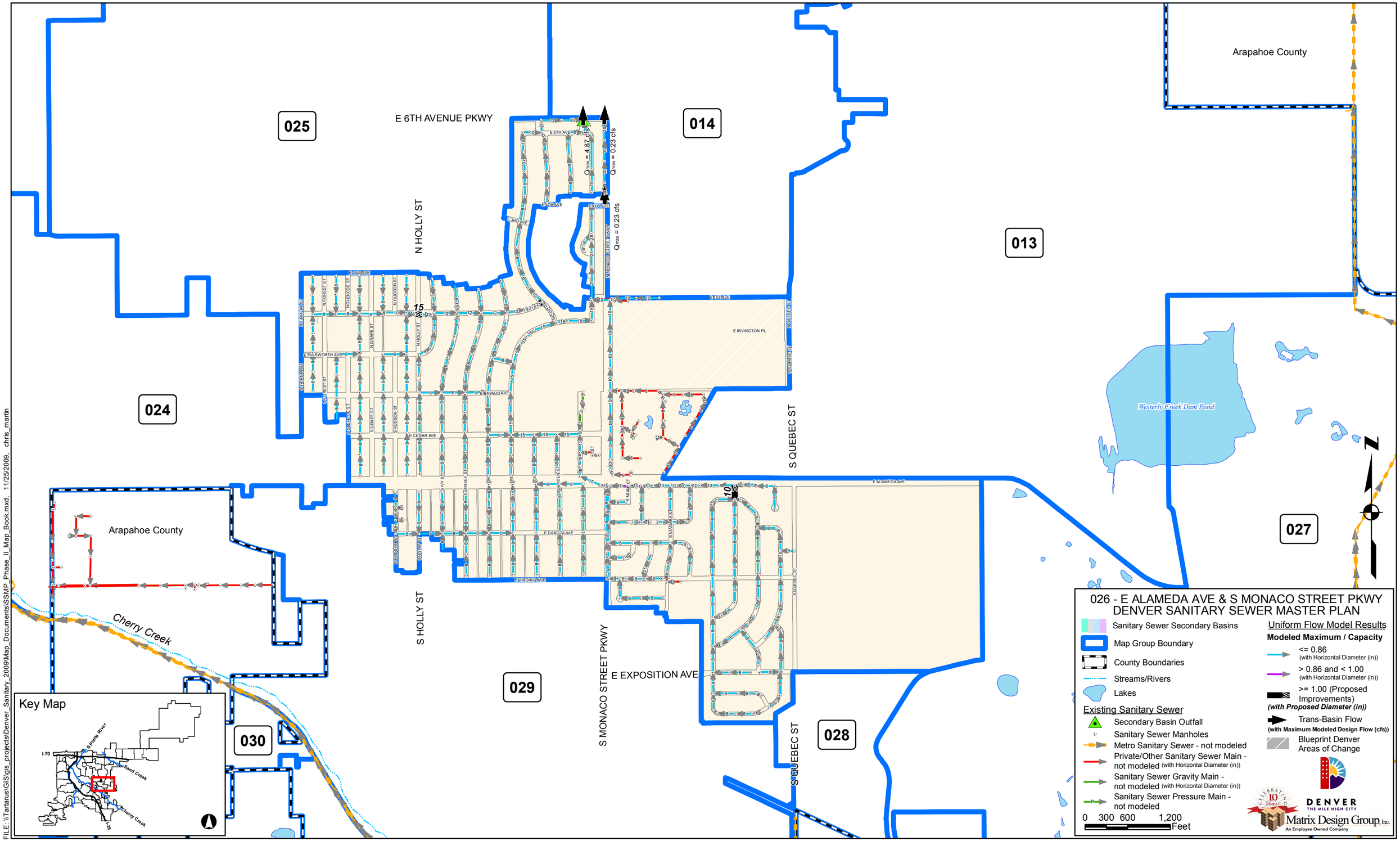
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	198	LF	$67	$13,266
15" DIAMETER PVC PIPE	133	LF	$76	$10,108
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	6	EA	$3,040	$18,240
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	2,979	SY-IN	$8	$23,834
WET UTILITY RELOCATE	1	EA		$11,770
DRY UTILITY RELOCATE			5%	$3,861
			SUBTOTAL	$81,079
TRAFFIC CONTROL			3%	$2,432
MOBILIZATION			10%	$8,108
ENGINEERING			15%	$12,162
MATERIALS MANAGEMENT			7%	$5,676
ADMINISTRATIVE			10%	$8,108
CONTINGENCY			25%	$20,270
	2008 ESTIMATED TOTAL COST			$137,835

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	118	0.1
<= 0.86	84,310	99.0
> 0.86 & < 1	439	0.5
≥ 1 & < 2	331	0.4
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	85,198	100

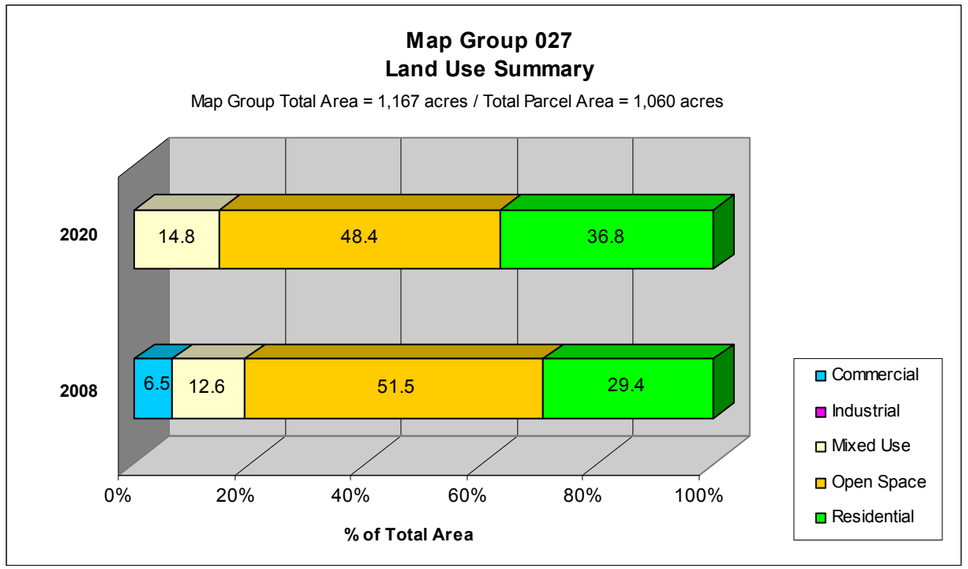
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 027 (E Alameda Ave & S Dayton St)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

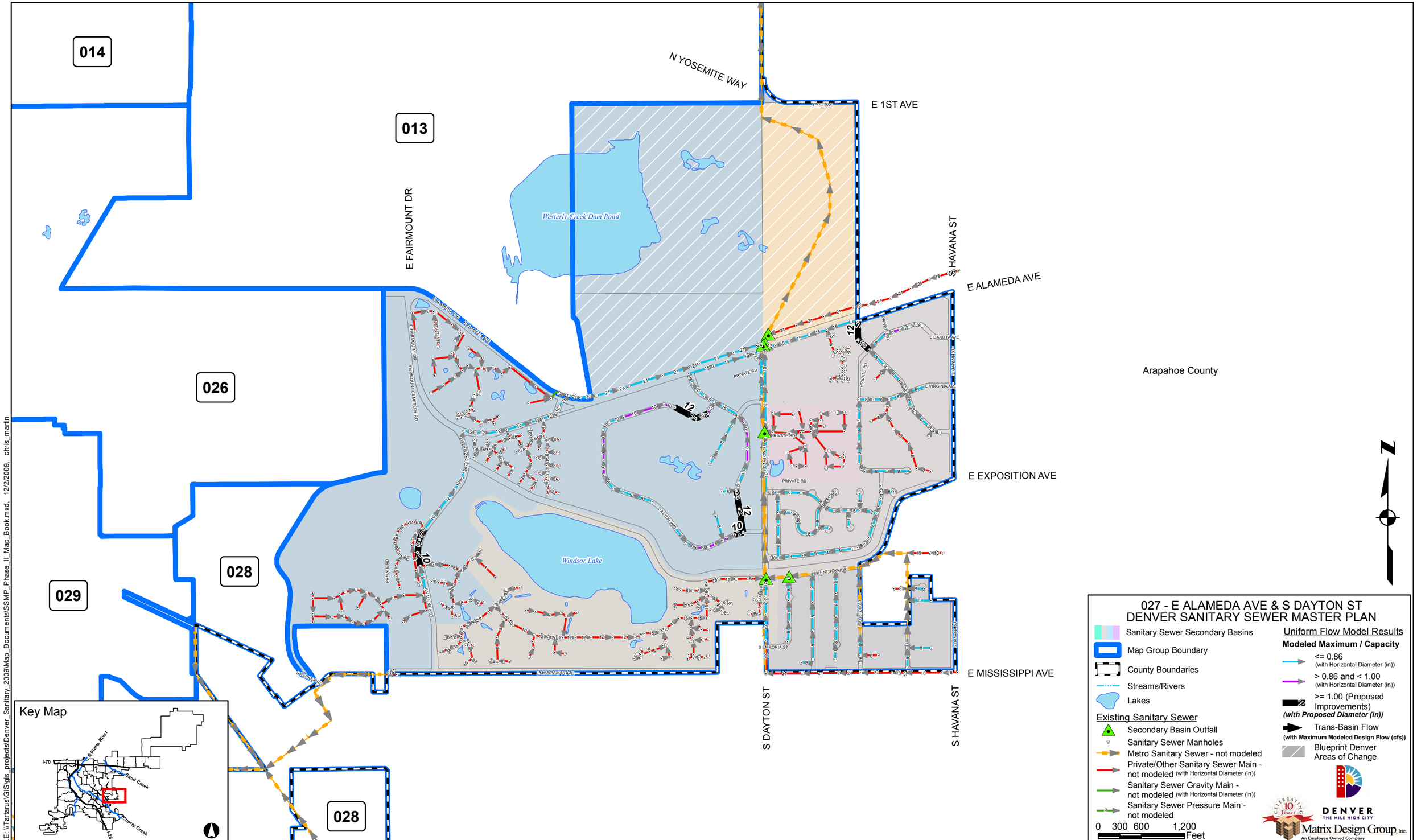
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	95	0.2
<= 0.86	33,649	86.0
> 0.86 & < 1	3,184	8.1
≥ 1 & < 2	2,217	5.7
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	39,145	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 027 COST ESTIMATE

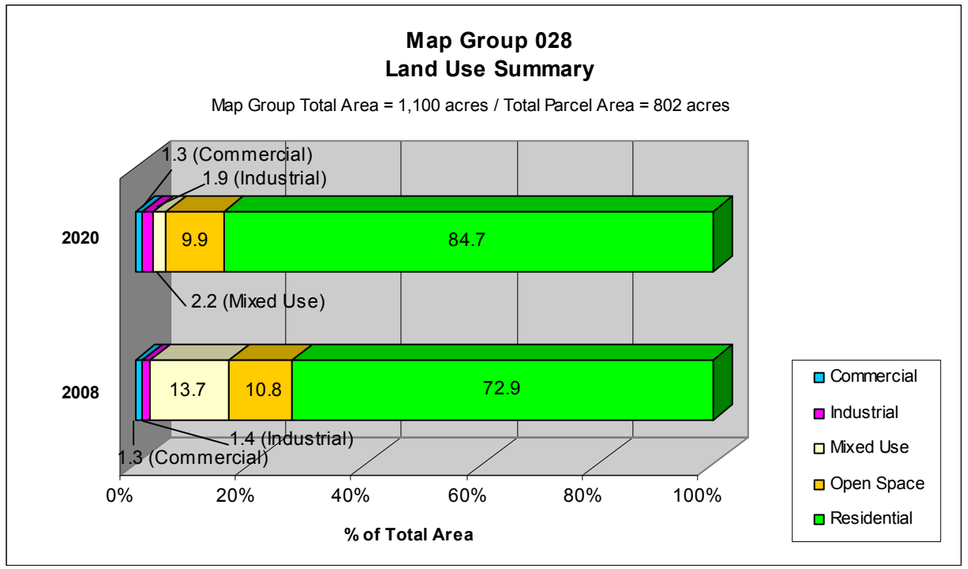
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	656	LF	$67	$43,952
12" DIAMETER PVC PIPE	1,560	LF	$71	$110,760
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	14	EA	$3,040	$42,560
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	19,835	SY-IN	$8	$158,667
WET UTILITY RELOCATE	1	EA		$10,165
DRY UTILITY RELOCATE			5%	$18,306
			SUBTOTAL	$384,420
TRAFFIC CONTROL			3%	$11,533
MOBILIZATION			10%	$38,442
ENGINEERING			15%	$57,663
MATERIALS MANAGEMENT			7%	$26,909
ADMINISTRATIVE			10%	$38,442
CONTINGENCY			25%	$96,105
	2008 ESTIMATED TOTAL COST			$653,514


014
013
026
028
029
028
N YOSEMITE WAY
E 1ST AVE
E FAIRMOUNT DR
Westerly Creek Dam Pond
S HAVANA ST
E ALAMEDA AVE
Arapahoe County
E EXPOSITION AVE
Windsor Lake
E MISSISSIPPI AVE
S DAYTON ST
S HAVANA ST
N
027 - E ALAMEDA AVE & S DAYTON ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
I-70
S Platte River
Sand Creek
Cherry Creek
I-25
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 12/2/2009 chris_martin

Map Group 028 (E Florida Ave & S Monaco Street Pkwy)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

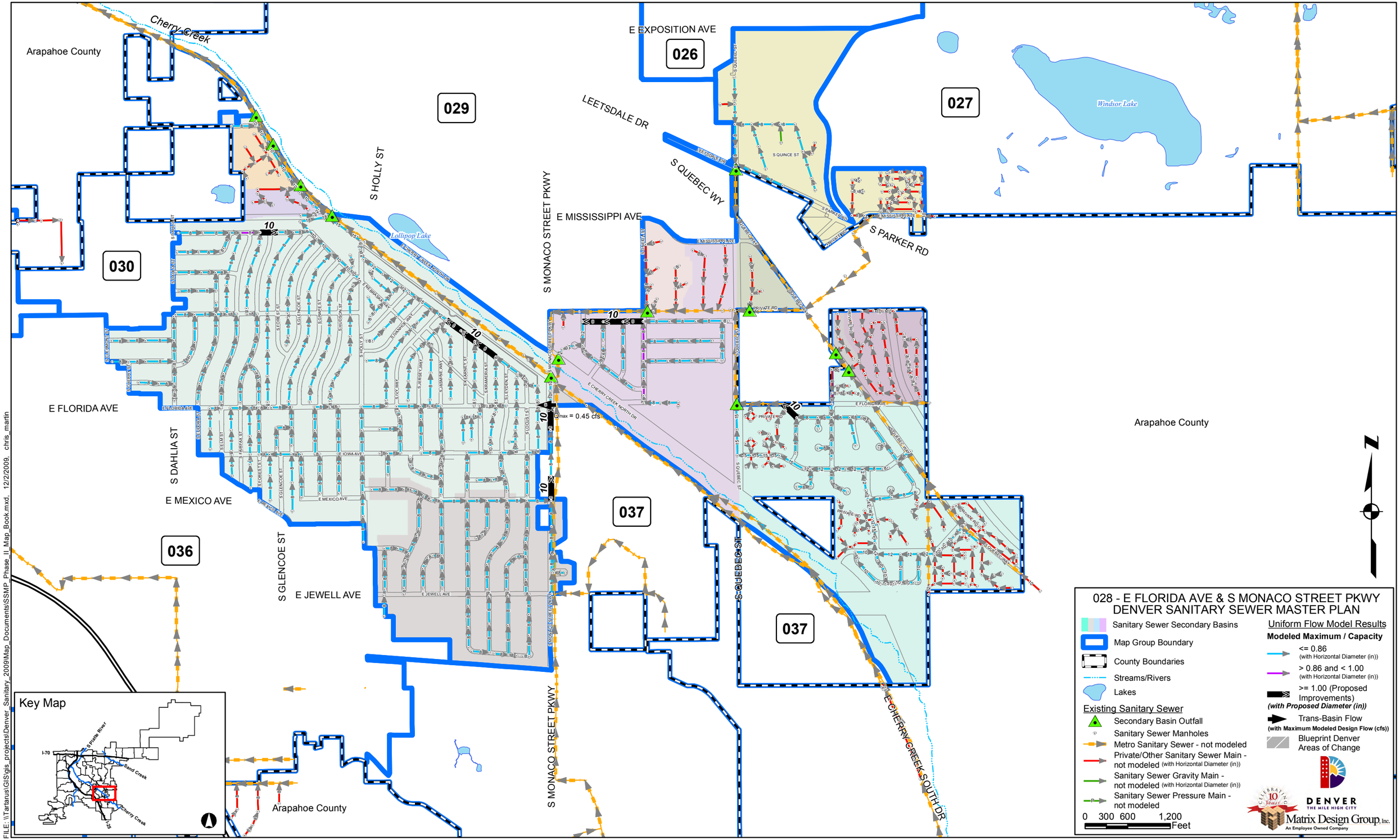
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	295	0.2
<= 0.86	114,046	96.3
> 0.86 & < 1	1,078	0.9
≥ 1 & < 2	2,950	2.5
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	118,369	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 028 COST ESTIMATE

SANITARY SEWER IMPROVEMENTS

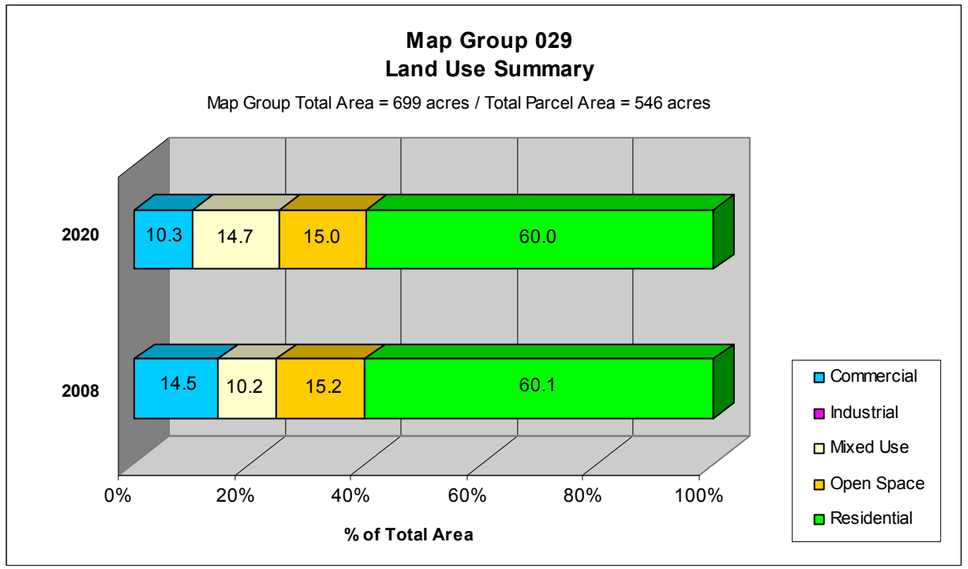
ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	2,949	LF	$67	$197,583
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	16	EA	$3,040	$48,640
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	26,050	SY-IN	$8	$208,396
WET UTILITY RELOCATE	1	EA		$17,655
DRY UTILITY RELOCATE			5%	$23,614
			SUBTOTAL	$495,888
TRAFFIC CONTROL			3%	$14,877
MOBILIZATION			10%	$49,589
ENGINEERING			15%	$74,383
MATERIALS MANAGEMENT			7%	$34,712
ADMINISTRATIVE			10%	$49,589
CONTINGENCY			25%	$123,972
	2008 ESTIMATED TOTAL COST			$843,010



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 12/2/2009 chris_martin

Map Group 029 (E Leetsdale Dr & S Monaco Street Pkwy)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

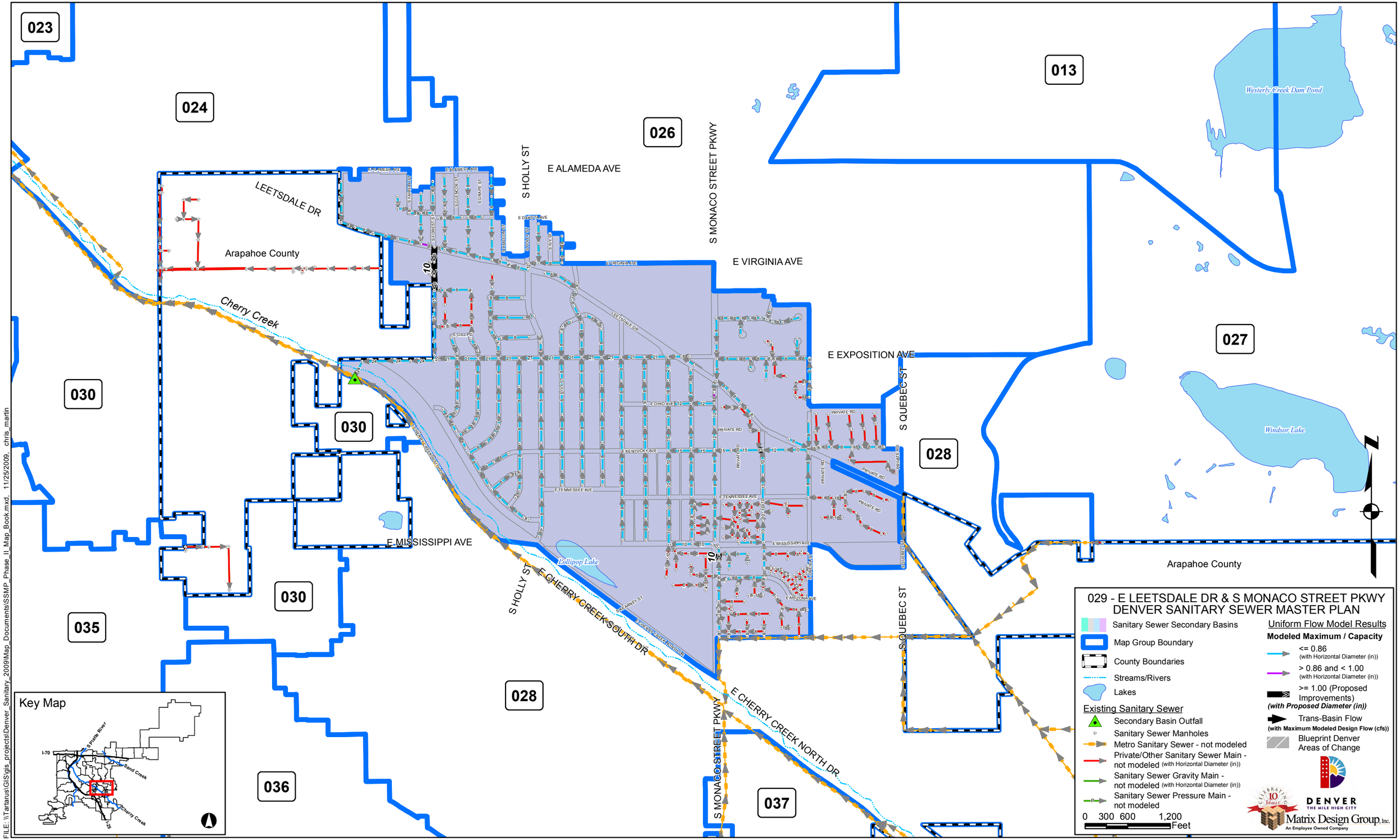
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	127	0.2
<= 0.86	67,975	98.2
> 0.86 & < 1	371	0.5
≥ 1 & < 2	760	1.1
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	69,234	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 029 COST ESTIMATE

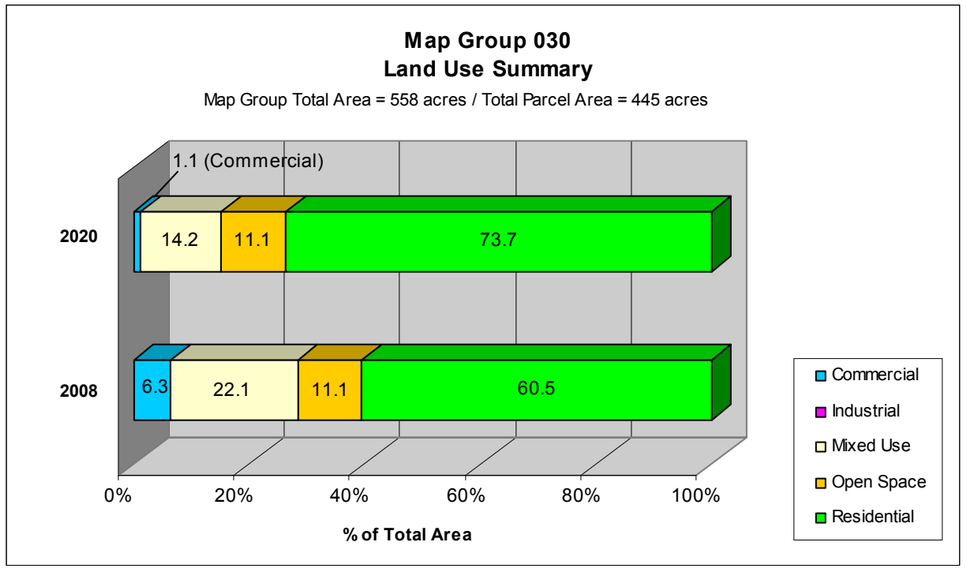
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	709	LF	$67	$47,503
18" DIAMETER PVC PIPE	52	LF	$81	$4,212
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	8	EA	$3,040	$24,320
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	6,757	SY-IN	$8	$54,055
WET UTILITY RELOCATE	1	EA		$14,980
DRY UTILITY RELOCATE			5%	$7,253
			SUBTOTAL	$152,323
TRAFFIC CONTROL			3%	$4,570
MOBILIZATION			10%	$15,232
ENGINEERING			15%	$22,848
MATERIALS MANAGEMENT			7%	$10,663
ADMINISTRATIVE			10%	$15,232
CONTINGENCY			25%	$38,081
	2008 ESTIMATED TOTAL COST			$258,949


023
024
013
026
027
030
030
030
035
028
028
036
037
Westerly Creek Dam Pond
Windsor Lake
Lollipop Lake
LEETSDALE DR
Arapahoe County
Cherry Creek
S HOLLY ST
E ALAMEDA AVE
S MONACO STREET PKWY
E VIRGINIA AVE
E EXPOSITION AVE
S QUEBEC ST
E MISSISSIPPI AVE
E CHERRY CREEK SOUTH DR
E CHERRY CREEK NORTH DR
Arapahoe County
029 - E LEETSDALE DR & S MONACO STREET PKWY
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
I-70
S Platte River
Sand Creek
Cherry Creek
I-25
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 030 (E Cherry Creek Dr & S Colorado Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 030 COST ESTIMATE

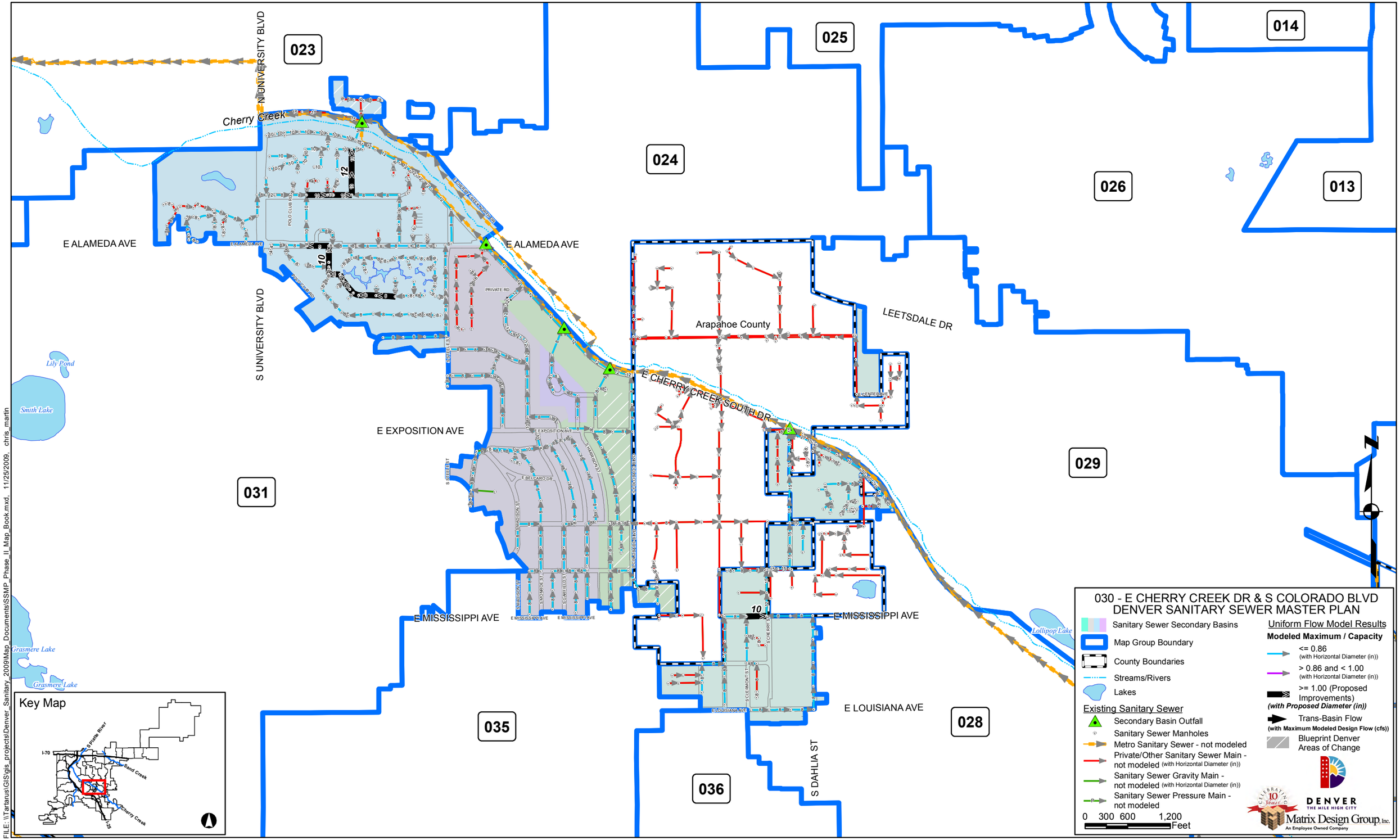
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	2,074	LF	$67	$138,958
12" DIAMETER PVC PIPE	1,283	LF	$71	$91,093
15" DIAMETER PVC PIPE	15	LF	$76	$1,140
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	23	EA	$3,040	$69,920
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	30,006	SY-IN	$8	$240,049
WET UTILITY RELOCATE	1	EA		$74,900
DRY UTILITY RELOCATE			5%	$30,803
			SUBTOTAL	$646,863
TRAFFIC CONTROL			3%	$19,406
MOBILIZATION			10%	$64,686
ENGINEERING			15%	$97,029
MATERIALS MANAGEMENT			7%	$45,280
ADMINISTRATIVE			10%	$64,686
CONTINGENCY			25%	$161,716
	2008 ESTIMATED TOTAL COST			$1,099,666

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	629	0.9
<= 0.86	66,805	94.3
> 0.86 & < 1	76	0.1
≥ 1 & < 2	3,370	4.8
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	70,880	100

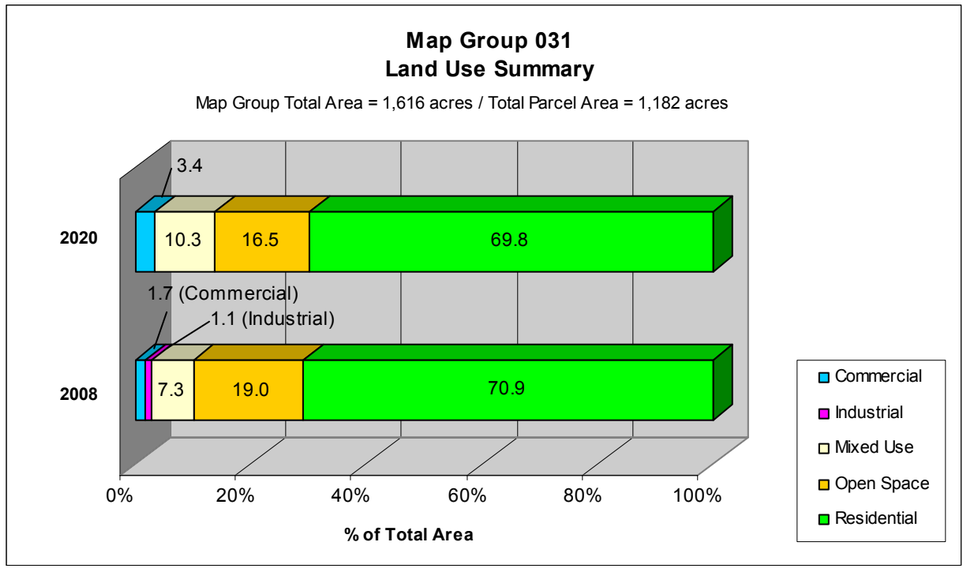
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 031 (E Exposition Ave & S University Blvd)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

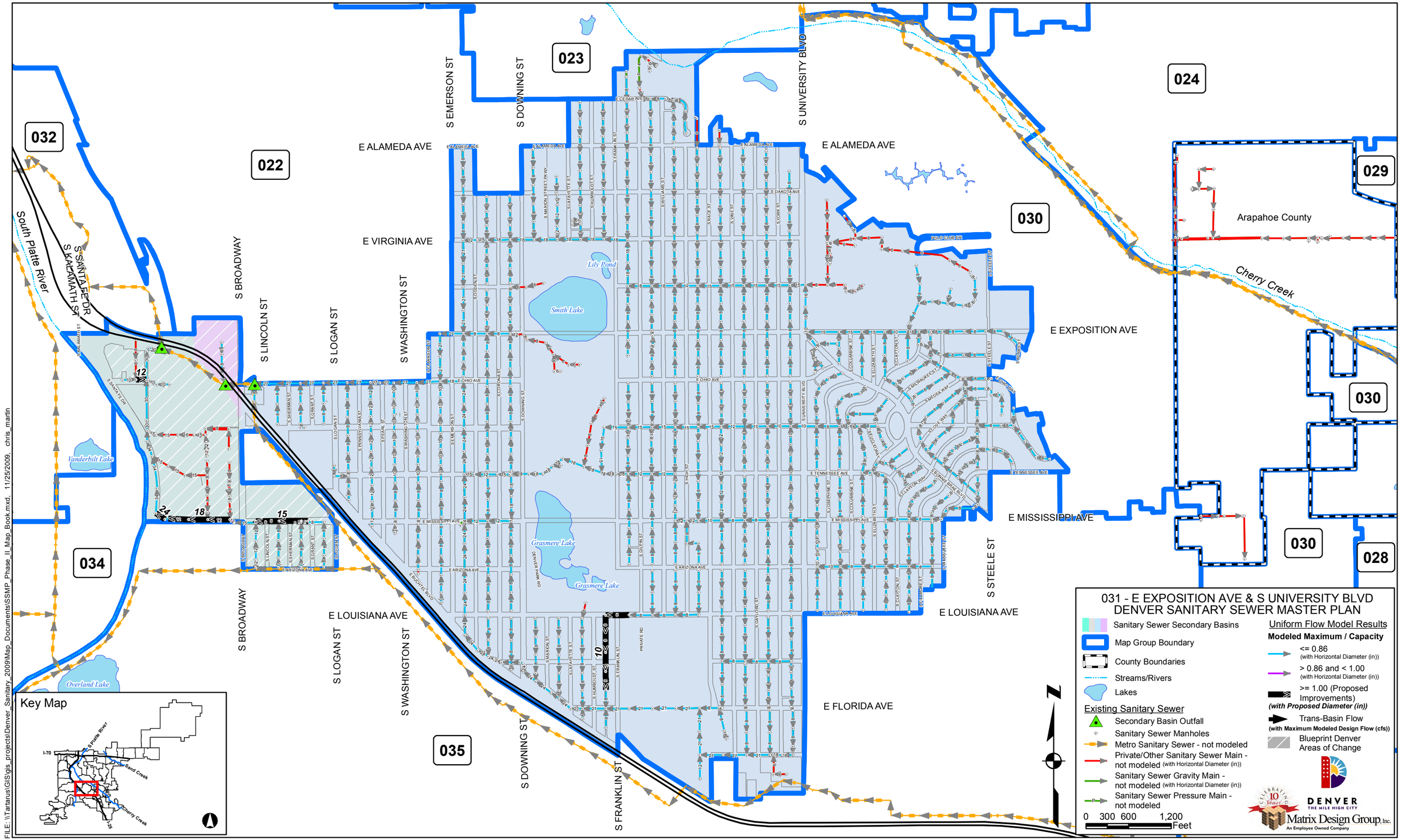
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	167	0.1
<= 0.86	182,736	98.1
> 0.86 & < 1	75	0.0
≥ 1 & < 2	2,454	1.3
≥ 2 & < 4	663	0.4
≥ 4	247	0.1
Total	186,342	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 031 COST ESTIMATE

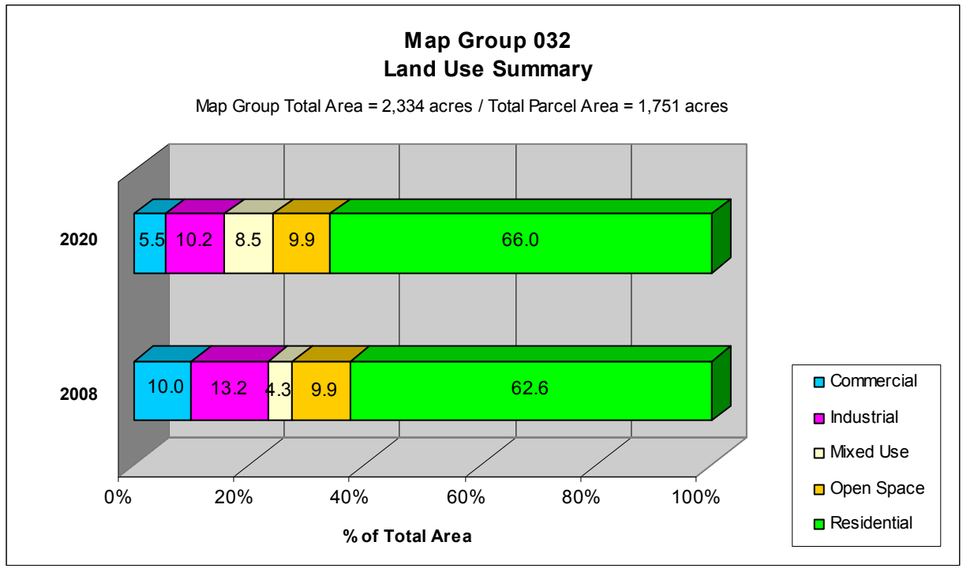
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	1,385	LF	$67	$92,795
12" DIAMETER PVC PIPE	146	LF	$71	$10,366
15" DIAMETER PVC PIPE	754	LF	$76	$57,304
18" DIAMETER PVC PIPE	868	LF	$81	$70,308
24" DIAMETER PVC PIPE	156	LF	$102	$15,912
33" DIAMETER PVC PIPE	56	LF	$132	$7,392
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	17	EA	$3,040	$51,680
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	4	EA	$4,570	$18,280
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	30,931	SY-IN	$8	$247,445
WET UTILITY RELOCATE	1	EA		$64,735
DRY UTILITY RELOCATE			5%	$31,811
			SUBTOTAL	$668,028
TRAFFIC CONTROL			3%	$20,041
MOBILIZATION			10%	$66,803
ENGINEERING			15%	$100,204
MATERIALS MANAGEMENT			7%	$46,762
ADMINISTRATIVE			10%	$66,803
CONTINGENCY			25%	$167,007
			2008 ESTIMATED TOTAL COST	$1,135,648


031 - E EXPOSITION AVE & S UNIVERSITY BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
South Platte River
S SANTA FE DR
S KALAMATH ST
S BROADWAY
S LINCOLN ST
S LOGAN ST
S WASHINGTON ST
S EMERSON ST
S DOWNING ST
S UNIVERSITY BLVD
S STEELE ST
S FRANKLIN ST
E ALAMEDA AVE
E VIRGINIA AVE
E EXPOSITION AVE
E MISSISSIPPI AVE
E LOUISIANA AVE
E FLORIDA AVE
Cherry Creek
Arapahoe County
Lily Pond
Smith Lake
Grasmere Lake
Vanderbilt Lake
Overland Lake
023
024
032
022
029
030
034
035
028
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 032 (W Alameda Ave & S Santa Fe Dr)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 032 COST ESTIMATE

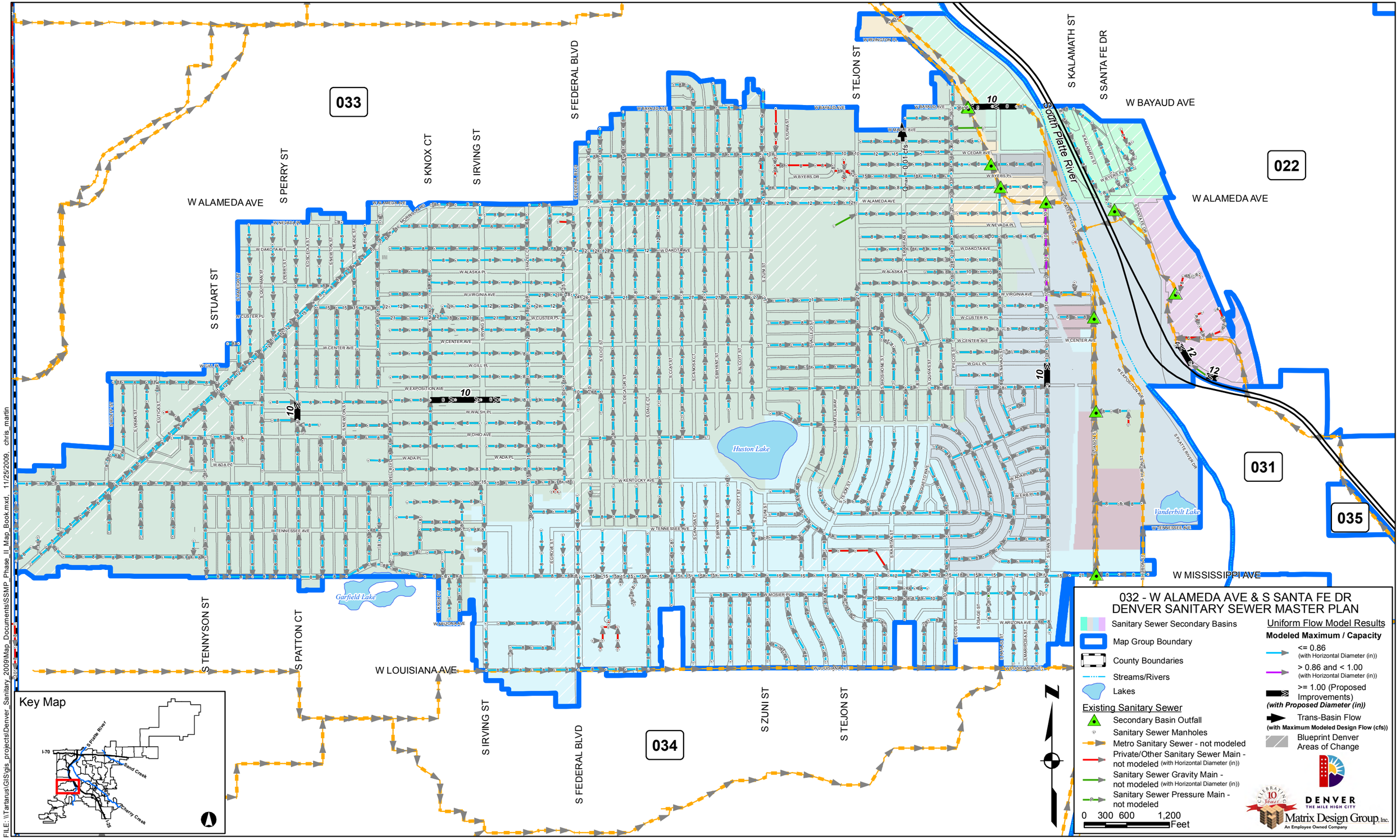
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	2,221	LF	$67	$148,807
10" DIAMETER PVC PIPE (JACK & BORE)	50	LF	$214	$10,700
12" DIAMETER PVC PIPE	532	LF	$71	$37,772
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	15	EA	$3,040	$45,600
TYPE B MANHOLE WITH TYPE A TOP SLAB	1	EA	$7,865	$7,865
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	24,407	SY-IN	$8	$195,255
WET UTILITY RELOCATE	1	EA		$12,840
DRY UTILITY RELOCATE			5%	$22,942
			SUBTOTAL	$481,781
TRAFFIC CONTROL			3%	$14,453
MOBILIZATION			10%	$48,178
ENGINEERING			15%	$72,267
MATERIALS MANAGEMENT			7%	$33,725
ADMINISTRATIVE			10%	$48,178
CONTINGENCY			25%	$120,445
	2008 ESTIMATED TOTAL COST			$819,027

Model Output Summary - Denver Owned Gravity Mains

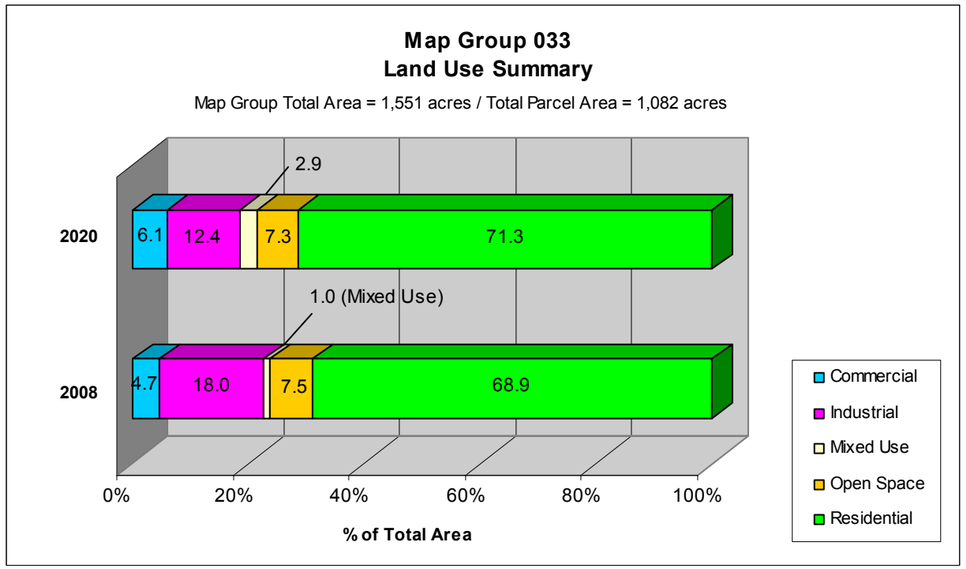
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	1,267	0.4
<= 0.86	330,138	98.4
> 0.86 & < 1	1,417	0.4
≥ 1 & < 2	2,425	0.7
≥ 2 & < 4	376	0.1
≥ 4	0	0.0
Total	335,624	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


032 - W ALAMEDA AVE & S SANTA FE DR
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
033
022
031
035
034
W ALAMEDA AVE
W BAYAUD AVE
W MISSISSIPPI AVE
W LOUISIANA AVE
S STUART ST
S PERRY ST
S KNOX CT
S IRVING ST
S FEDERAL BLVD
S TEJON ST
S KALAMATH ST
S SANTA FE DR
S TENNYSON ST
S PATTON CT
S ZUNI ST
South Platte River
Huston Lake
Garfield Lake
Vanderbilt Lake
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 033 (W 2nd Ave & N Federal Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 033 COST ESTIMATE

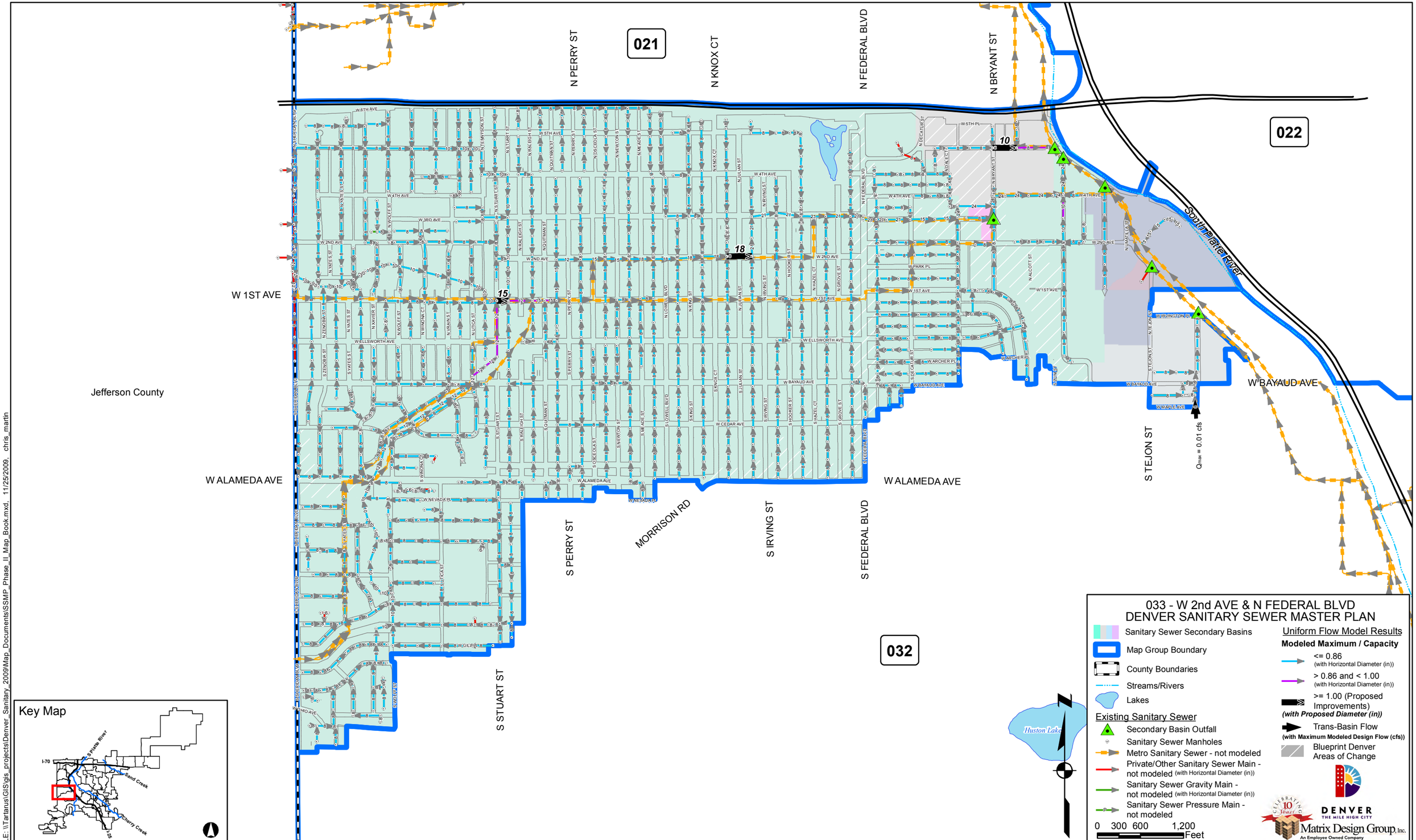
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	335	LF	$67	$22,445
15" DIAMETER PVC PIPE	161	LF	$76	$12,236
18" DIAMETER PVC PIPE	345	LF	$81	$27,945
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	6	EA	$3,040	$18,240
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	7,726	SY-IN	$8	$61,807
WET UTILITY RELOCATE	1	EA		$8,025
DRY UTILITY RELOCATE			5%	$7,535
			SUBTOTAL	$158,233
TRAFFIC CONTROL			3%	$4,747
MOBILIZATION			10%	$15,823
ENGINEERING			15%	$23,735
MATERIALS MANAGEMENT			7%	$11,076
ADMINISTRATIVE			10%	$15,823
CONTINGENCY			25%	$39,558
	2008 ESTIMATED TOTAL COST			$268,995

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	150	0.1
<= 0.86	227,522	98.3
> 0.86 & < 1	2,890	1.2
≥ 1 & < 2	496	0.2
≥ 2 & < 4	0	0.0
≥ 4	345	0.1
Total	231,403	100

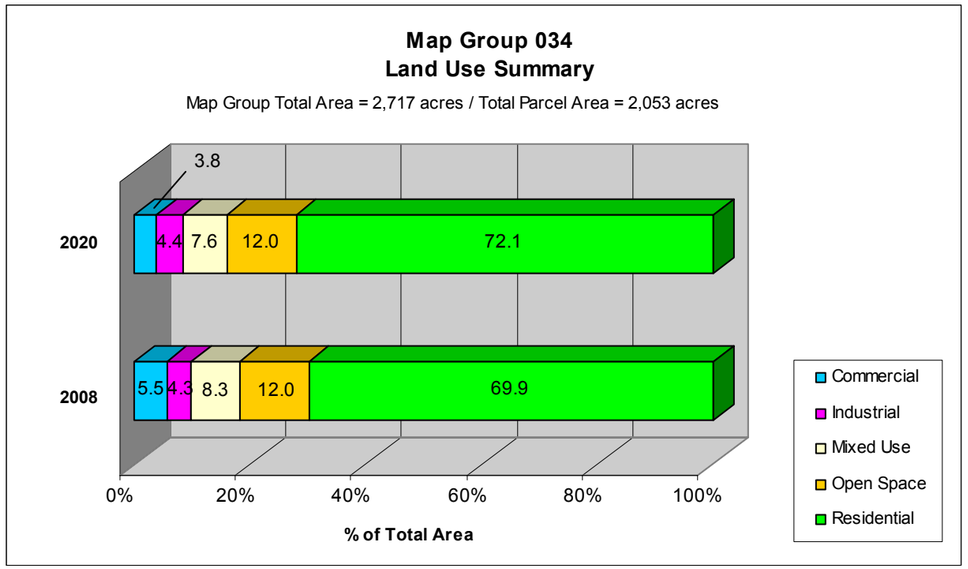
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

Map Group 034 (W Jewell Ave & S Federal Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 034 COST ESTIMATE

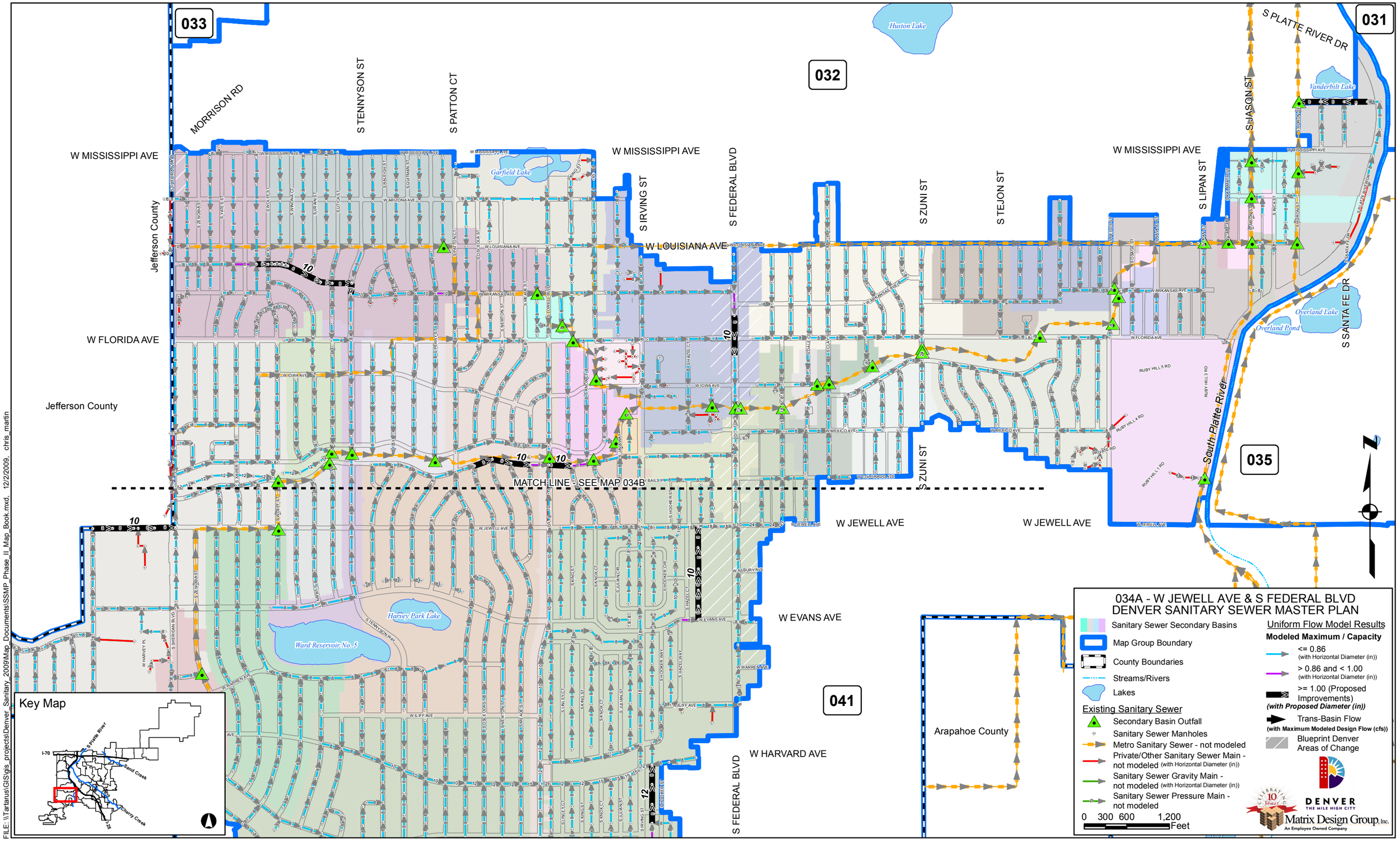
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	6,249	LF	$67	$418,683
12" DIAMETER PVC PIPE	1,769	LF	$71	$125,599
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	45	EA	$3,040	$136,800
TYPE B MANHOLE WITH TYPE A TOP SLAB	1	EA	$7,865	$7,865
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	71,121	SY-IN	$8	$568,964
WET UTILITY RELOCATE	1	EA		$83,995
DRY UTILITY RELOCATE			5%	$67,095
			SUBTOTAL	$1,409,001
TRAFFIC CONTROL			3%	$42,270
MOBILIZATION			10%	$140,900
ENGINEERING			15%	$211,350
MATERIALS MANAGEMENT			7%	$98,630
ADMINISTRATIVE			10%	$140,900
CONTINGENCY			25%	$352,250
	2008 ESTIMATED TOTAL COST			$2,395,301

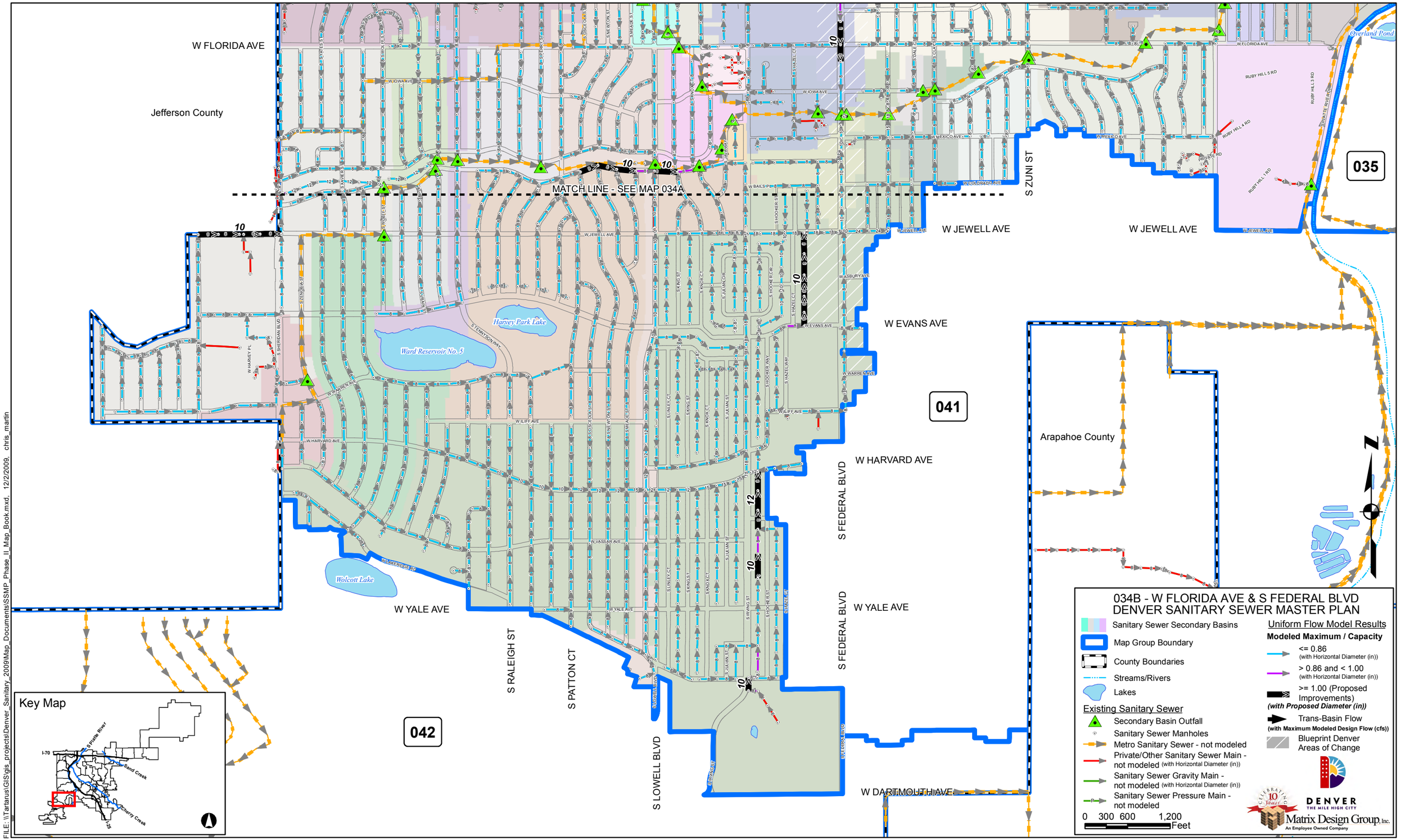
Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	155	0.0
<= 0.86	347,438	96.9
> 0.86 & < 1	2,821	0.8
≥ 1 & < 2	7,472	2.1
≥ 2 & < 4	545	0.2
≥ 4	0	0.0
Total	358,432	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


034A - W JEWELL AVE & S FEDERAL BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
033
032
031
035
041
Jefferson County
Arapahoe County
MATCH LINE - SEE MAP 034B
W MISSISSIPPI AVE
W LOUISIANA AVE
W FLORIDA AVE
W JEWELL AVE
W EVANS AVE
W HARVARD AVE
S FEDERAL BLVD
S ZUNI ST
S TEJON ST
S LIPAN ST
S JASON ST
S IRVING ST
S PATTON CT
S TENNYSON ST
MORRISON RD
S PLATTE RIVER DR
S SANTA FE DR
South Platte River
Huston Lake
Vanderbilt Lake
Garfield Lake
Overland Lake
Overland Pond
Harvey Park Lake
Ward Reservoir No. 5

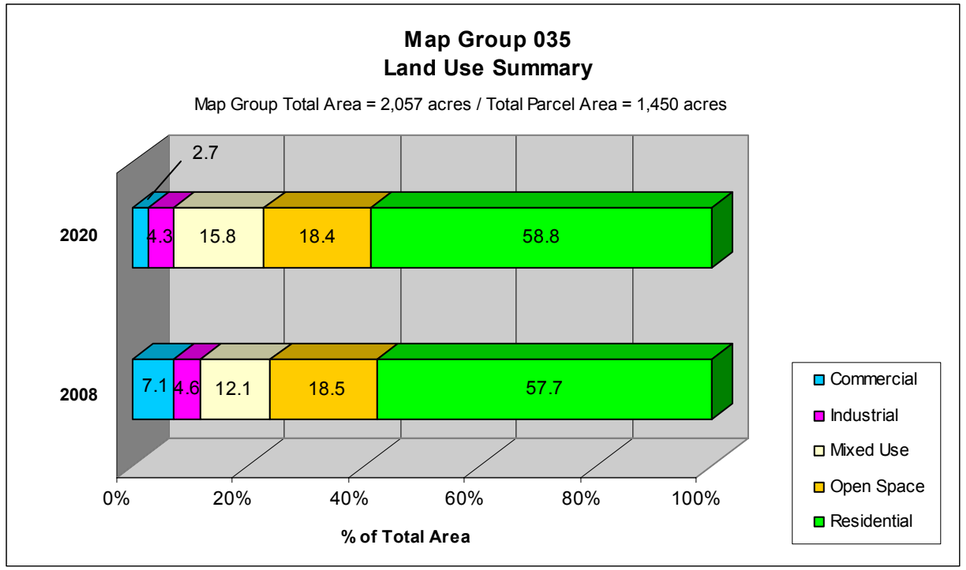
This page intentionally blank



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 12/2/2009, chris_martin

Map Group 035 (E Evans Ave & S Downing St)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 035 COST ESTIMATE

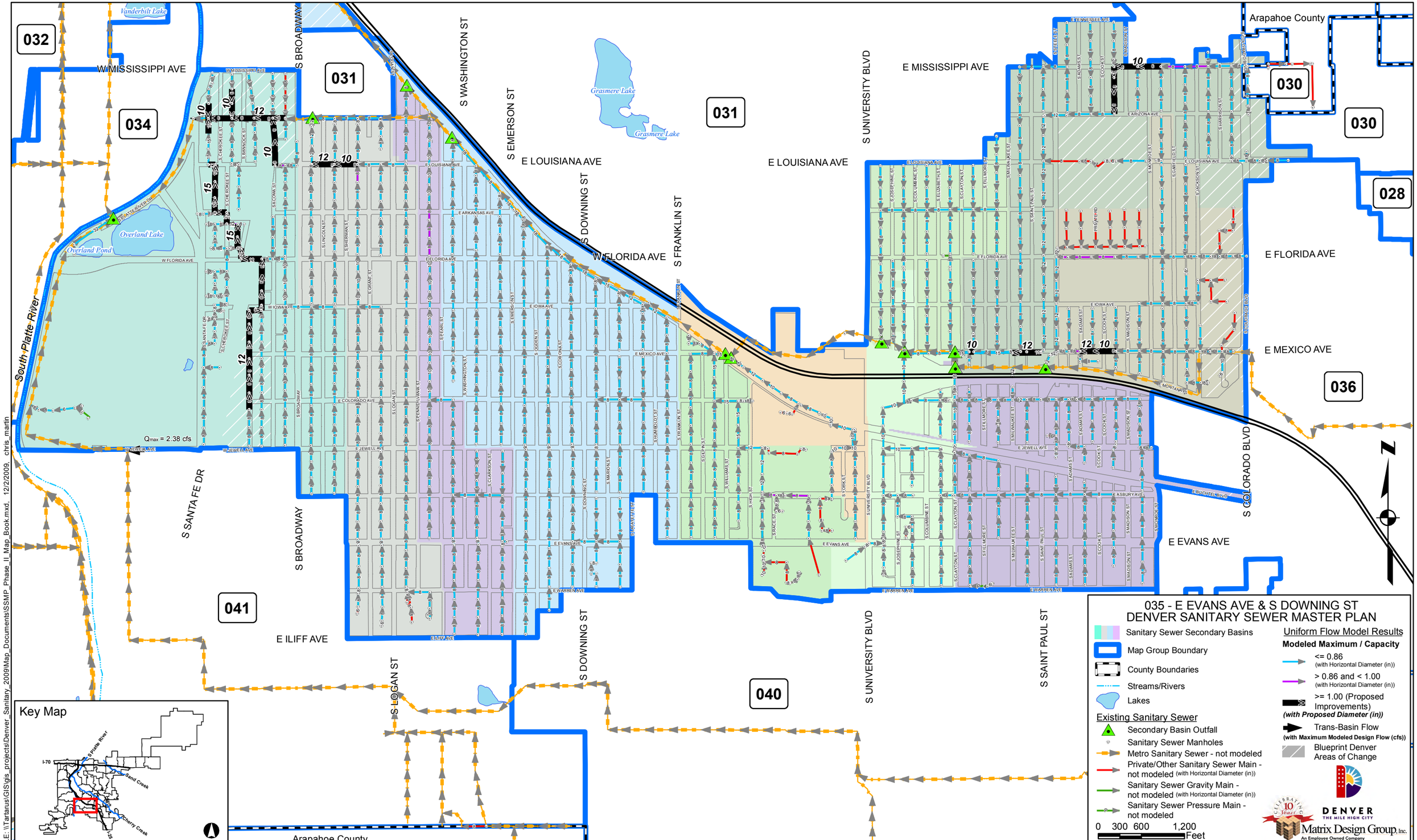
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	3,493	LF	$67	$234,031
12" DIAMETER PVC PIPE	4,152	LF	$71	$294,792
12" DIAMETER PVC PIPE (JACK & BORE)	123	LF	$257	$31,611
15" DIAMETER PVC PIPE	1,812	LF	$76	$137,712
15" DIAMETER PVC PIPE (JACK & BORE)	111	LF	$321	$35,631
24" DIAMETER PVC PIPE	18	LF	$102	$1,836
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	54	EA	$3,040	$164,160
TYPE B MANHOLE WITH TYPE A TOP SLAB	1	EA	$7,865	$7,865
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	85,164	SY-IN	$8	$681,311
WET UTILITY RELOCATE	1	EA		$177,085
DRY UTILITY RELOCATE			5%	$88,302
			SUBTOTAL	$1,854,336
TRAFFIC CONTROL			3%	$55,630
MOBILIZATION			10%	$185,434
ENGINEERING			15%	$278,150
MATERIALS MANAGEMENT			7%	$129,804
ADMINISTRATIVE			10%	$185,434
CONTINGENCY			25%	$463,584
			2008 ESTIMATED TOTAL COST	$3,152,372

Model Output Summary - Denver Owned Gravity Mains

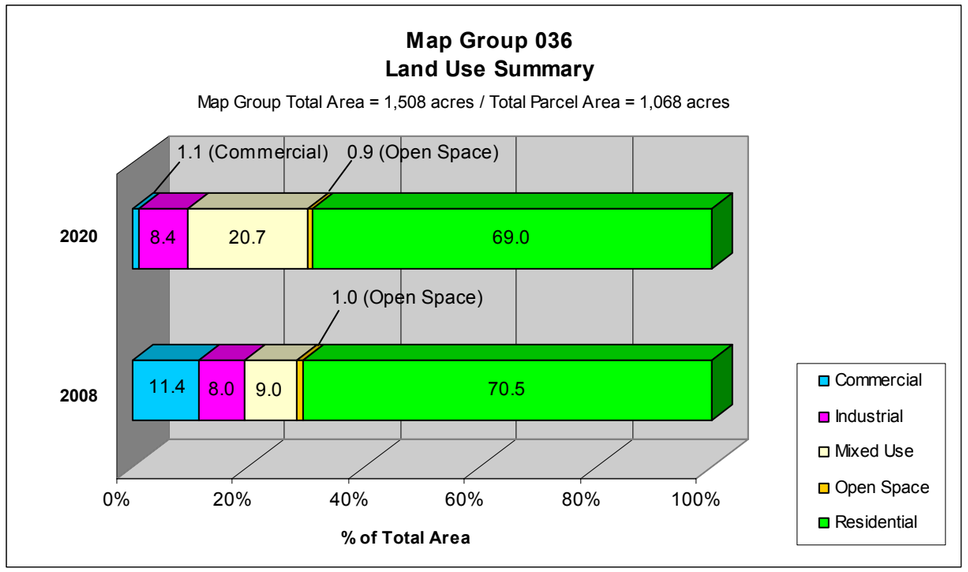
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	440	0.2
<= 0.86	220,630	94.1
> 0.86 & < 1	3,670	1.6
≥ 1 & < 2	7,371	3.1
≥ 2 & < 4	2,335	1.0
≥ 4	0	0.0
Total	234,446	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


035 - E EVANS AVE & S DOWNING ST
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
South Platte River
Sand Creek
Cherry Creek
I-70
I-25
Arapahoe County
Vanderbilt Lake
Overland Lake
Overland Pond
Grasmere Lake
Qmax = 2.38 cfs
W MISSISSIPPI AVE
E MISSISSIPPI AVE
E LOUISIANA AVE
W FLORIDA AVE
E FLORIDA AVE
E MEXICO AVE
E EVANS AVE
E ILIFF AVE
S BROADWAY
S SANTA FE DR
S WASHINGTON ST
S EMERSON ST
S DOWNING ST
S FRANKLIN ST
S UNIVERSITY BLVD
S COLORADO BLVD
S SAINT PAUL ST
S LOGAN ST
032
034
031
030
028
036
041
040
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 12/2/2009 chris_martin

Map Group 036 (I-25 & E Evans Ave)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 036 COST ESTIMATE

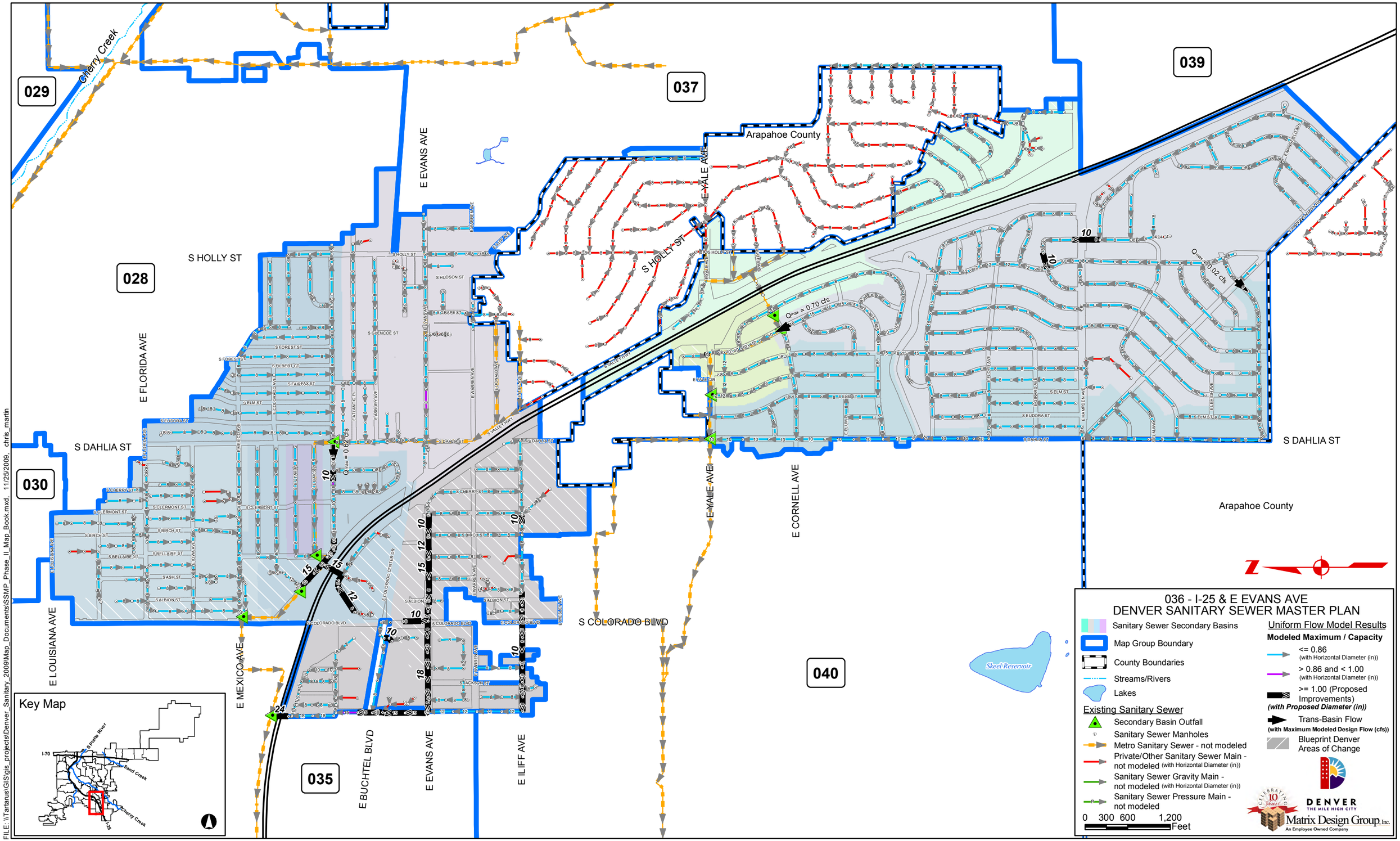
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	3,353	LF	$67	$224,651
10" DIAMETER PVC PIPE (JACK & BORE)	78	LF	$214	$16,692
12" DIAMETER PVC PIPE	769	LF	$71	$54,599
15" DIAMETER PVC PIPE	1,511	LF	$76	$114,836
15" DIAMETER PVC PIPE (JACK & BORE)	177	LF	$321	$56,817
18" DIAMETER PVC PIPE	2,820	LF	$81	$228,420
18" DIAMETER PVC PIPE (JACK & BORE)	52	LF	$385	$20,020
24" DIAMETER PVC PIPE	133	LF	$102	$13,566
24" DIAMETER PVC PIPE (JACK & BORE)	119	LF	$514	$61,166
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	59	EA	$3,040	$179,360
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	78,636	SY-IN	$8	$629,087
WET UTILITY RELOCATE	1	EA		$151,940
DRY UTILITY RELOCATE			5%	$87,558
			SUBTOTAL	$1,838,712
TRAFFIC CONTROL			3%	$55,161
MOBILIZATION			10%	$183,871
ENGINEERING			15%	$275,807
MATERIALS MANAGEMENT			7%	$128,710
ADMINISTRATIVE			10%	$183,871
CONTINGENCY			25%	$459,678
			2008 ESTIMATED TOTAL COST	$3,125,810

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	154	0.1
<= 0.86	181,061	94.4
> 0.86 & < 1	1,503	0.8
≥ 1 & < 2	5,646	2.9
≥ 2 & < 4	1,847	1.0
≥ 4	1,520	0.8
Total	191,731	100

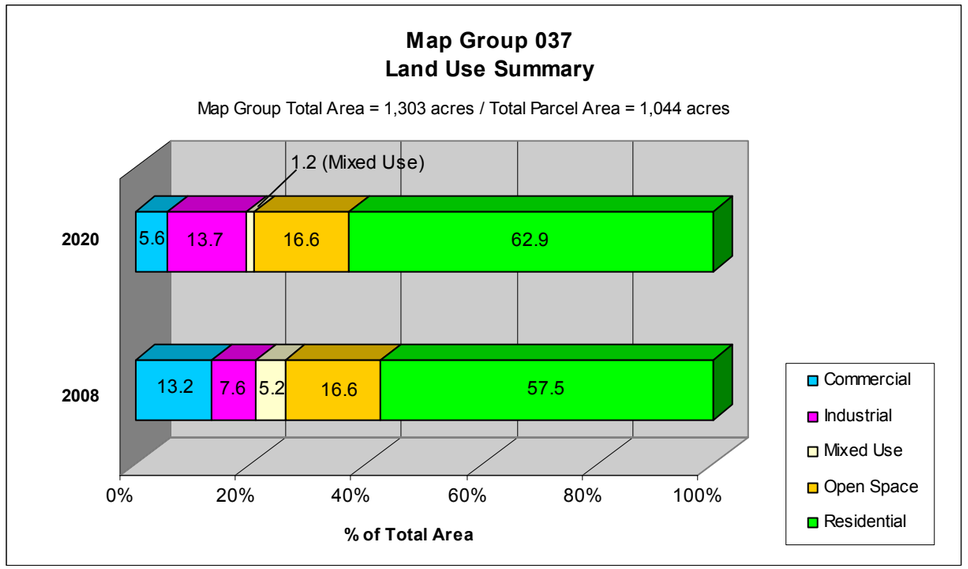
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 037 (E Yale Ave & S Monaco Street Pkwy)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 037 COST ESTIMATE

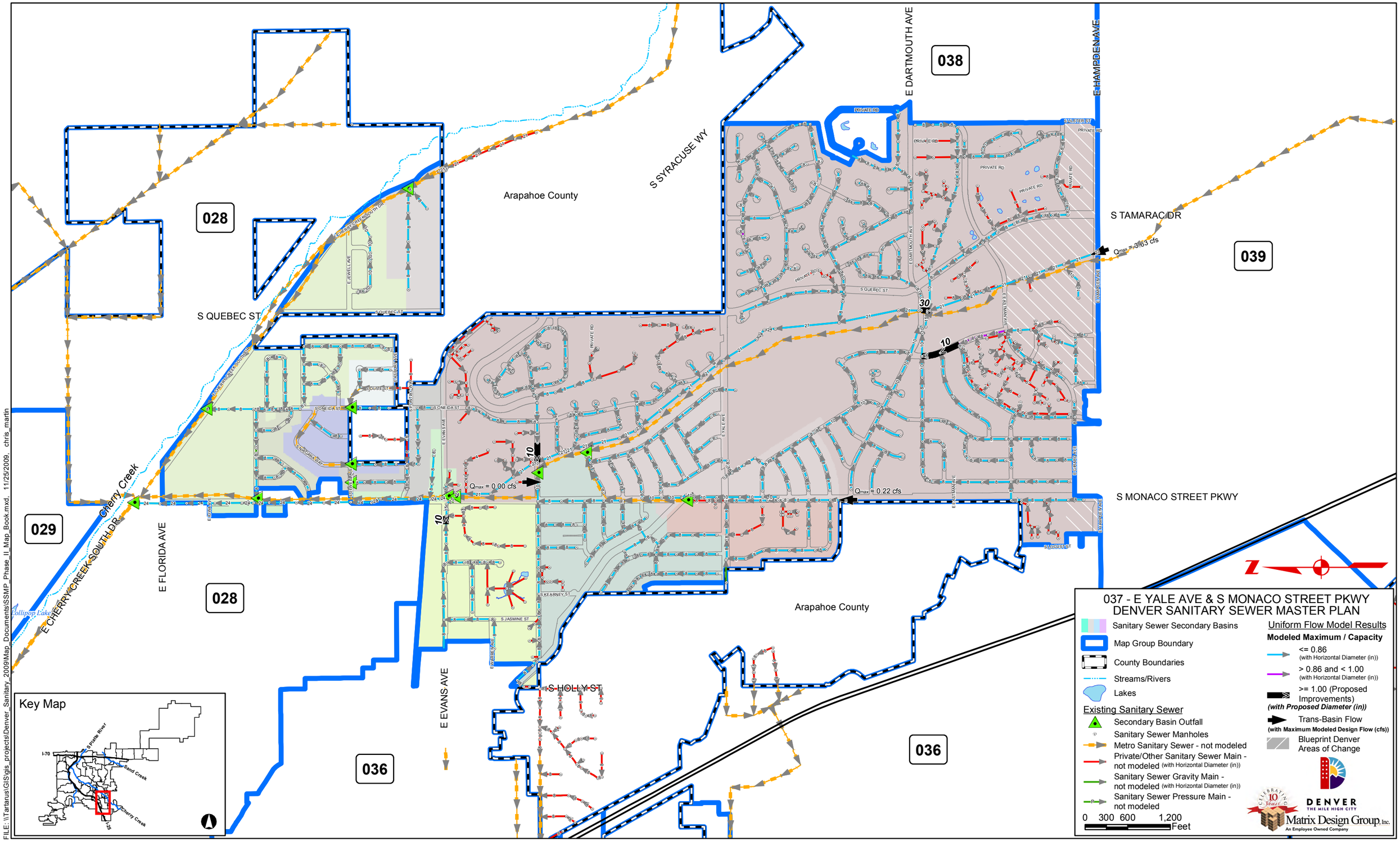
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	939	LF	$67	$62,913
27" DIAMETER PVC PIPE	40	LF	$108	$4,320
30" DIAMETER PVC PIPE	78	LF	$120	$9,360
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	8	EA	$3,040	$24,320
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	2	EA	$4,570	$9,140
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	9,524	SY-IN	$8	$76,188
WET UTILITY RELOCATE	1	EA		$8,560
DRY UTILITY RELOCATE			5%	$9,740
			SUBTOTAL	$204,541
TRAFFIC CONTROL			3%	$6,136
MOBILIZATION			10%	$20,454
ENGINEERING			15%	$30,681
MATERIALS MANAGEMENT			7%	$14,318
ADMINISTRATIVE			10%	$20,454
CONTINGENCY			25%	$51,135
	2008 ESTIMATED TOTAL COST			$347,719

Model Output Summary - Denver Owned Gravity Mains

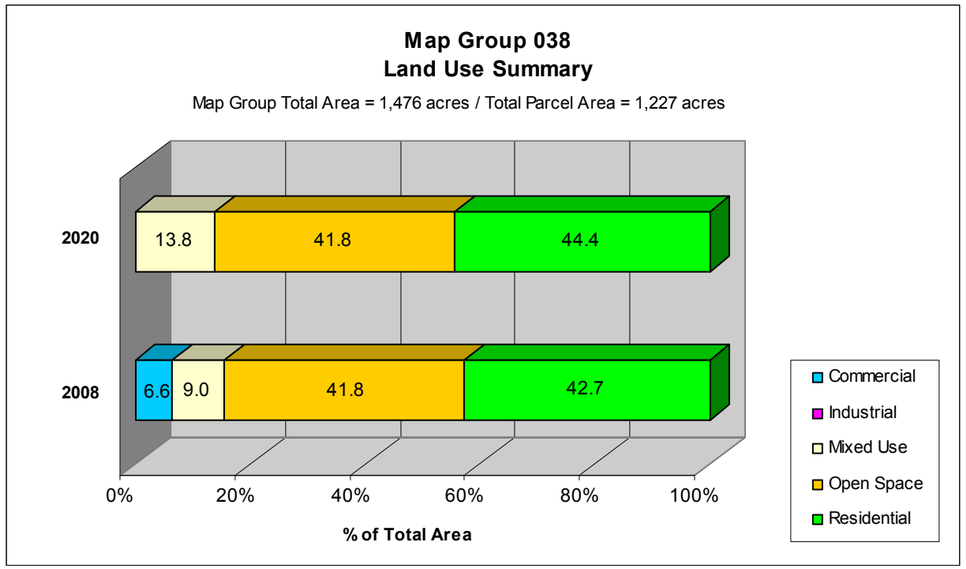
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	430	0.3
<= 0.86	143,761	98.4
> 0.86 & < 1	829	0.6
≥ 1 & < 2	1,057	0.7
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	146,077	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


037 - E YALE AVE & S MONACO STREET PKWY
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
I-25
028
029
038
039
036
Arapahoe County
S SYRACUSE WY
E DARTMOUTH AVE
E HAMPDEN AVE
S TAMARAC DR
S MONACO STREET PKWY
S QUEBEC ST
E FLORIDA AVE
E CHERRY CREEK SOUTH DR
Cherry Creek
Lollipop Lake
E EVANS AVE
S HOLLY ST
Qmax = 3.63 cfs
Qmax = 0.00 cfs
Qmax = 0.22 cfs
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 038 (E Yale Ave & S Dayton Way)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 038 COST ESTIMATE

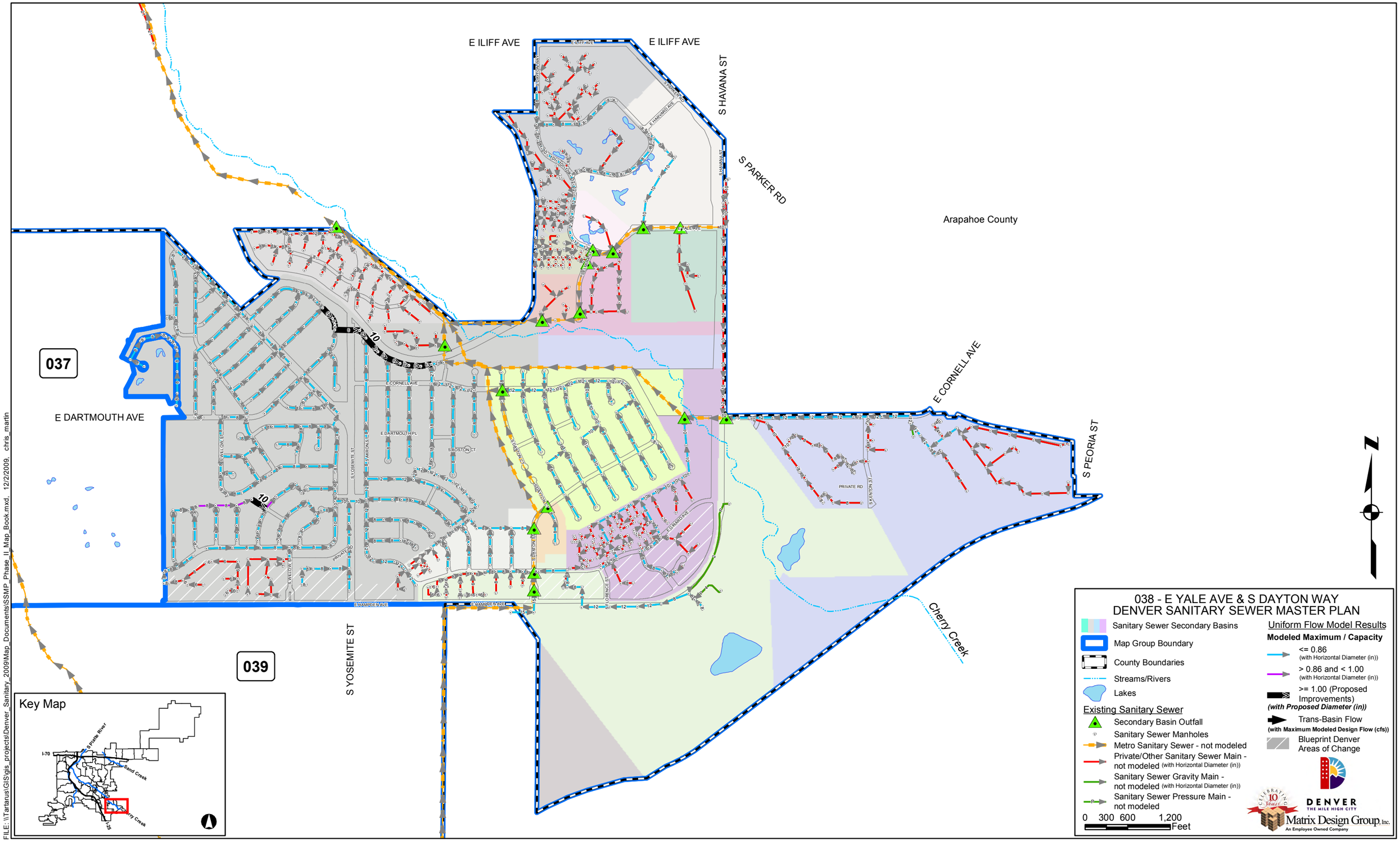
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	2,156	LF	$67	$144,452
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	14	EA	$3,040	$42,560
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	19,045	SY-IN	$8	$152,357
WET UTILITY RELOCATE	1	EA		$26,750
DRY UTILITY RELOCATE			5%	$18,306
			SUBTOTAL	$384,425
TRAFFIC CONTROL			3%	$11,533
MOBILIZATION			10%	$38,442
ENGINEERING			15%	$57,664
MATERIALS MANAGEMENT			7%	$26,910
ADMINISTRATIVE			10%	$38,442
CONTINGENCY			25%	$96,106
	2008 ESTIMATED TOTAL COST			$653,522

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	191	0.2
<= 0.86	94,598	96.6
> 0.86 & < 1	1,011	1.0
≥ 1 & < 2	2,155	2.2
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	97,955	100

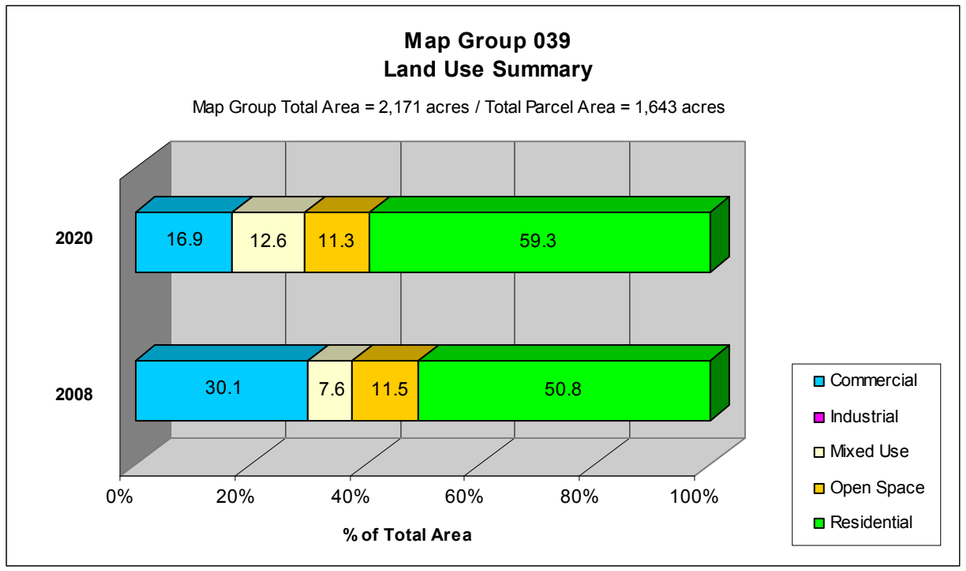
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 12/2/2009, chris_martin

Map Group 039 (I-25 & E Quincy Ave)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

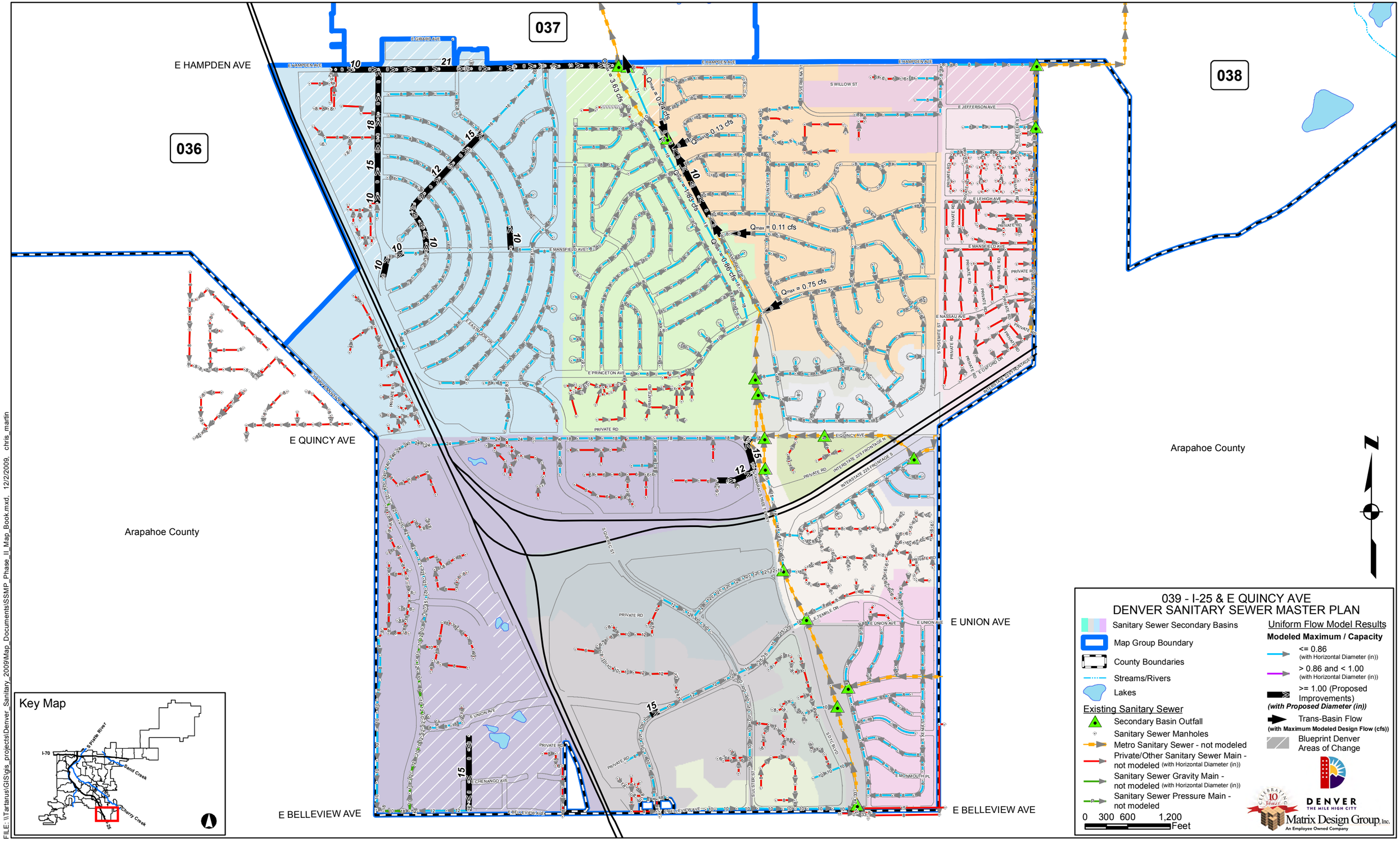
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	3,177	1.8
<= 0.86	164,252	91.3
> 0.86 & < 1	175	0.1
≥ 1 & < 2	6,993	3.9
≥ 2 & < 4	1,951	1.1
≥ 4	3,436	1.9
Total	179,983	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 039 COST ESTIMATE

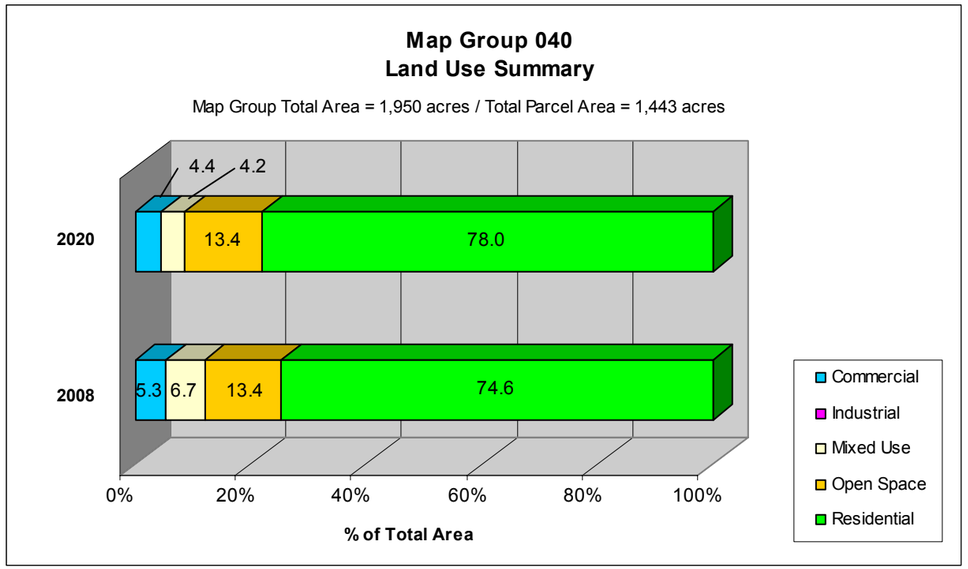
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	3,442	LF	$67	$230,614
10" DIAMETER PVC PIPE (JACK & BORE)	75	LF	$214	$16,050
12" DIAMETER PVC PIPE	1,712	LF	$71	$121,552
15" DIAMETER PVC PIPE	2,794	LF	$76	$212,344
18" DIAMETER PVC PIPE	341	LF	$81	$27,621
21" DIAMETER PVC PIPE	3,868	LF	$92	$355,856
21" DIAMETER PVC PIPE (JACK & BORE)	72	LF	$449	$32,328
30" DIAMETER PVC PIPE	77	LF	$120	$9,240
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	64	EA	$3,040	$194,560
5 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	1	EA	$4,570	$4,570
TYPE B MANHOLE WITH TYPE A TOP SLAB	1	EA	$7,865	$7,865
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	113,418	SY-IN	$8	$907,343
WET UTILITY RELOCATE	1	EA		$143,915
DRY UTILITY RELOCATE			5%	$113,193
			SUBTOTAL	$2,377,051
TRAFFIC CONTROL			3%	$71,312
MOBILIZATION			10%	$237,705
ENGINEERING			15%	$356,558
MATERIALS MANAGEMENT			7%	$166,394
ADMINISTRATIVE			10%	$237,705
CONTINGENCY			25%	$594,263
			2008 ESTIMATED TOTAL COST	$4,040,988


037
038
036
E HAMPDEN AVE
E QUINCY AVE
E UNION AVE
E BELLEVIEW AVE
Arapahoe County
Arapahoe County
Qmax = 3.63 cfs
Qmax = 0.24 cfs
Qmax = 0.13 cfs
Qmax = 1.89 cfs
Qmax = 0.11 cfs
Qmax = 0.86 cfs
Qmax = 0.75 cfs
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
I-25
039 - I-25 & E QUINCY AVE
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 12/2/2009, chris_martin

Map Group 040 (E Yale Ave & S Colorado Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 040 COST ESTIMATE

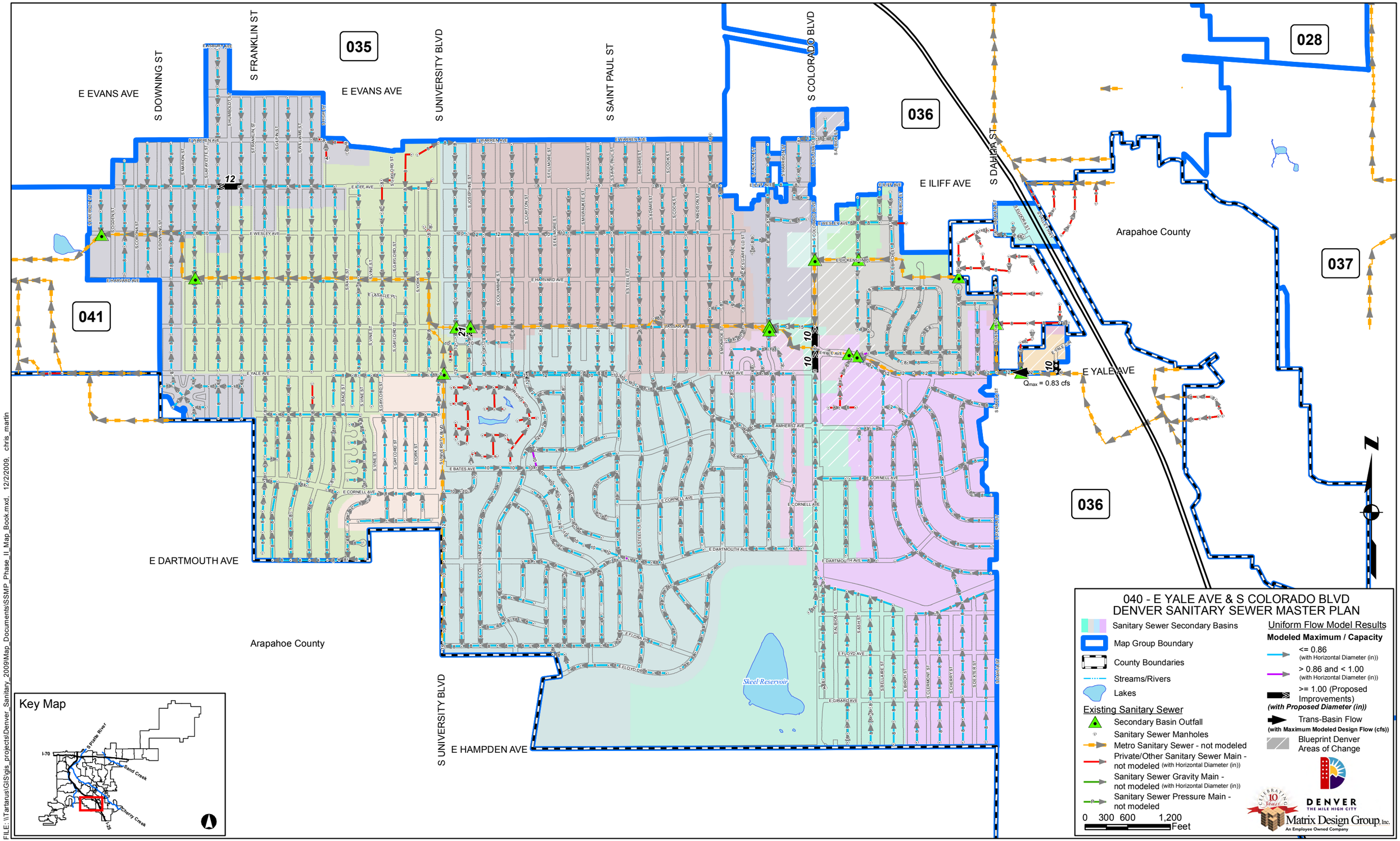
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	805	LF	$67	$53,935
12" DIAMETER PVC PIPE	333	LF	$71	$23,643
15" DIAMETER PVC PIPE	54	LF	$76	$4,104
21" DIAMETER PVC PIPE	135	LF	$92	$12,420
42" DIAMETER PVC PIPE	42	LF	$168	$7,056
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	16	EA	$3,040	$48,640
TYPE B MANHOLE WITH TYPE A TOP SLAB	2	EA	$7,865	$15,730
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	12,407	SY-IN	$8	$99,253
WET UTILITY RELOCATE	1	EA		$28,890
DRY UTILITY RELOCATE			5%	$14,684
			SUBTOTAL	$308,355
TRAFFIC CONTROL			3%	$9,251
MOBILIZATION			10%	$30,836
ENGINEERING			15%	$46,253
MATERIALS MANAGEMENT			7%	$21,585
ADMINISTRATIVE			10%	$30,836
CONTINGENCY			25%	$77,089
			2008 ESTIMATED TOTAL COST	$524,205

Model Output Summary - Denver Owned Gravity Mains

Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	80	0.0
<= 0.86	256,064	99.2
> 0.86 & < 1	726	0.3
≥ 1 & < 2	1,272	0.5
≥ 2 & < 4	54	0.0
≥ 4	42	0.0
Total	258,237	100

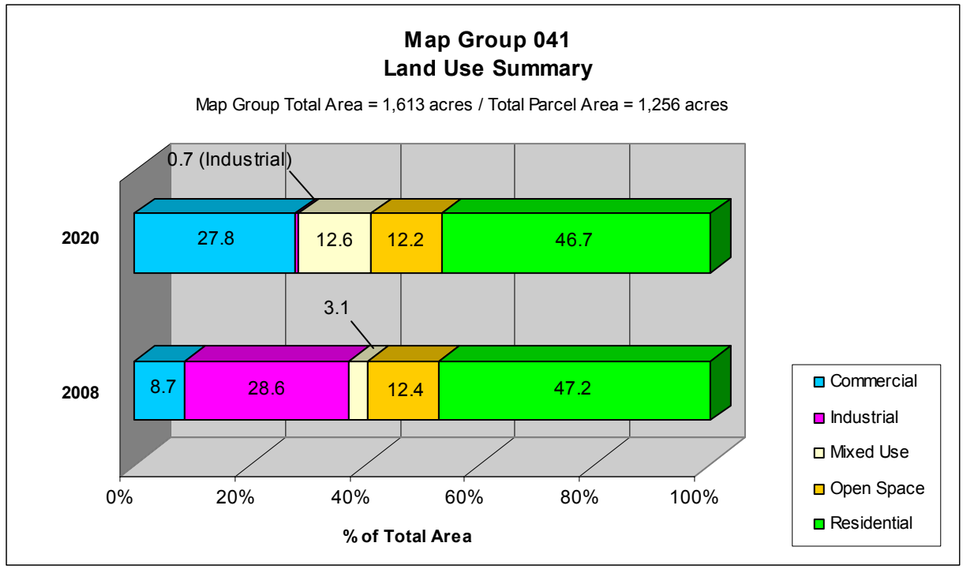
*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 12/2/2009, chris_martin

Map Group 041 (E Evans Ave & S Santa Fe Dr)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

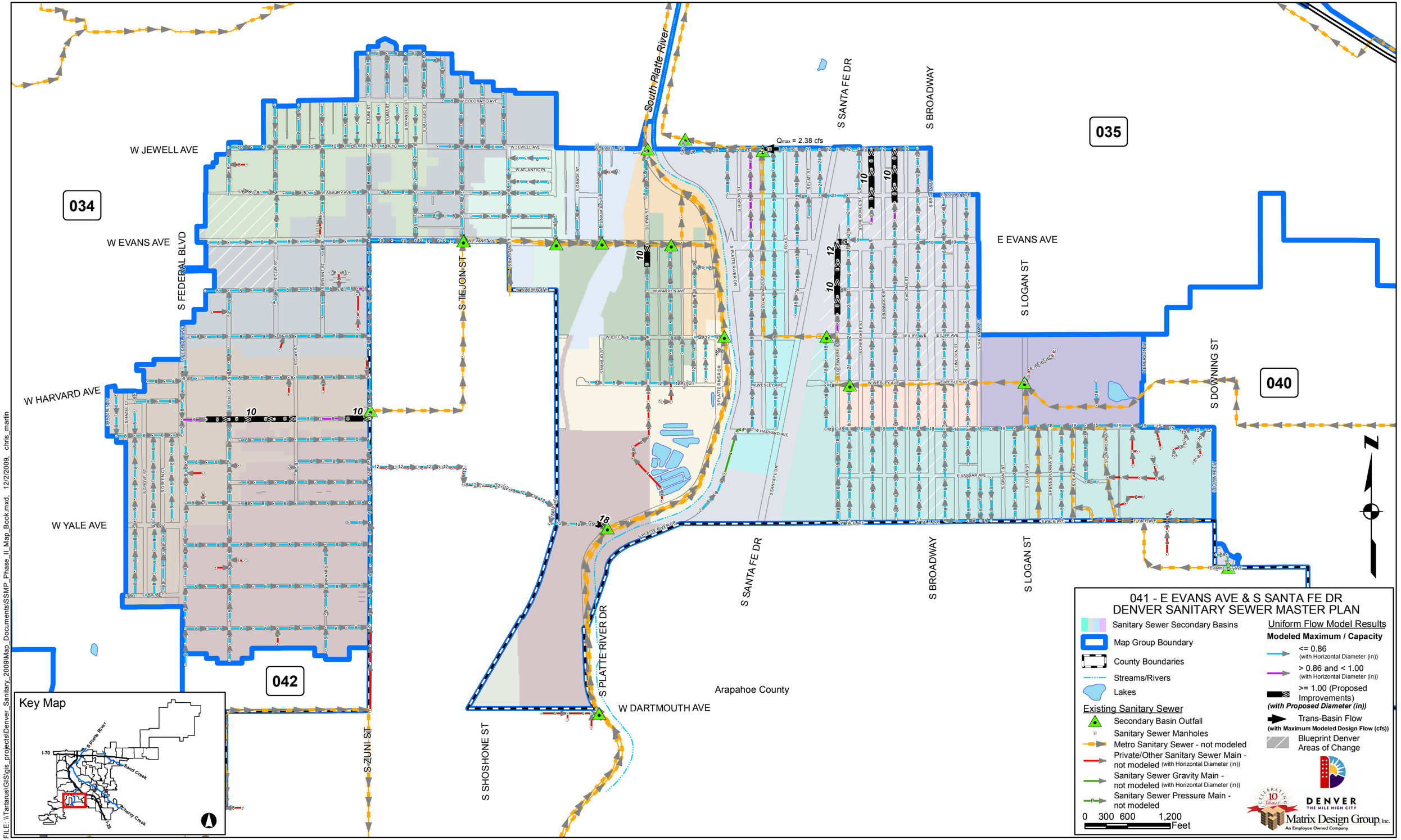
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	183	0.1
<= 0.86	155,573	95.0
> 0.86 & < 1	3,033	1.9
≥ 1 & < 2	4,976	3.0
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	163,765	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 041 COST ESTIMATE

SANITARY SEWER IMPROVEMENTS

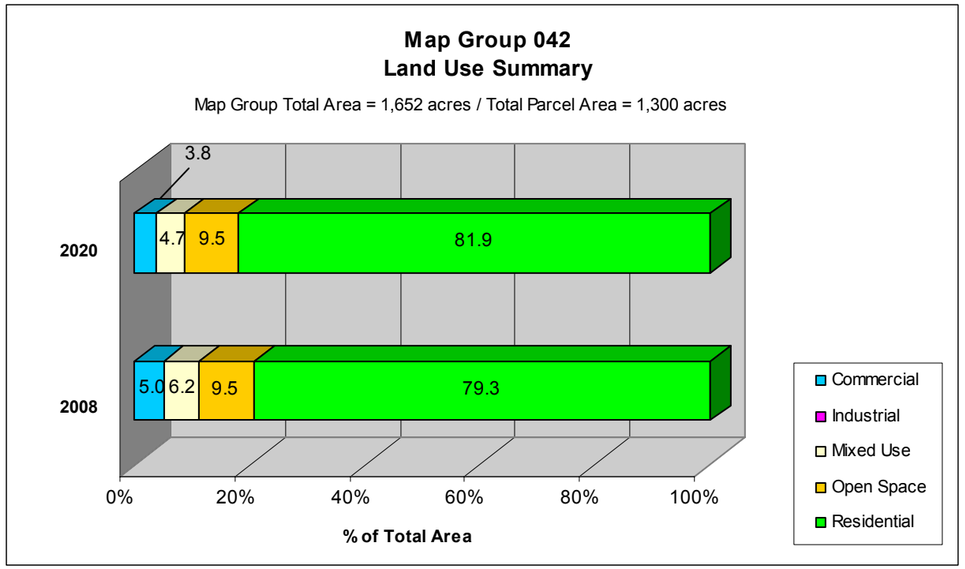
ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	4,403	LF	$67	$295,001
12" DIAMETER PVC PIPE	323	LF	$71	$22,933
12" DIAMETER PVC PIPE (JACK & BORE)	91	LF	$257	$23,387
18" DIAMETER PVC PIPE	159	LF	$81	$12,879
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	26	EA	$3,040	$79,040
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	43,311	SY-IN	$8	$346,485
WET UTILITY RELOCATE	1	EA		$54,570
DRY UTILITY RELOCATE			5%	$41,715
			SUBTOTAL	$876,010
TRAFFIC CONTROL			3%	$26,280
MOBILIZATION			10%	$87,601
ENGINEERING			15%	$131,402
MATERIALS MANAGEMENT			7%	$61,321
ADMINISTRATIVE			10%	$87,601
CONTINGENCY			25%	$219,002
	2008 ESTIMATED TOTAL COST			$1,489,217



FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 12/2/2009 chris_martin

Map Group 042 (W Dartmouth Ave & S Sheridan Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 042 COST ESTIMATE

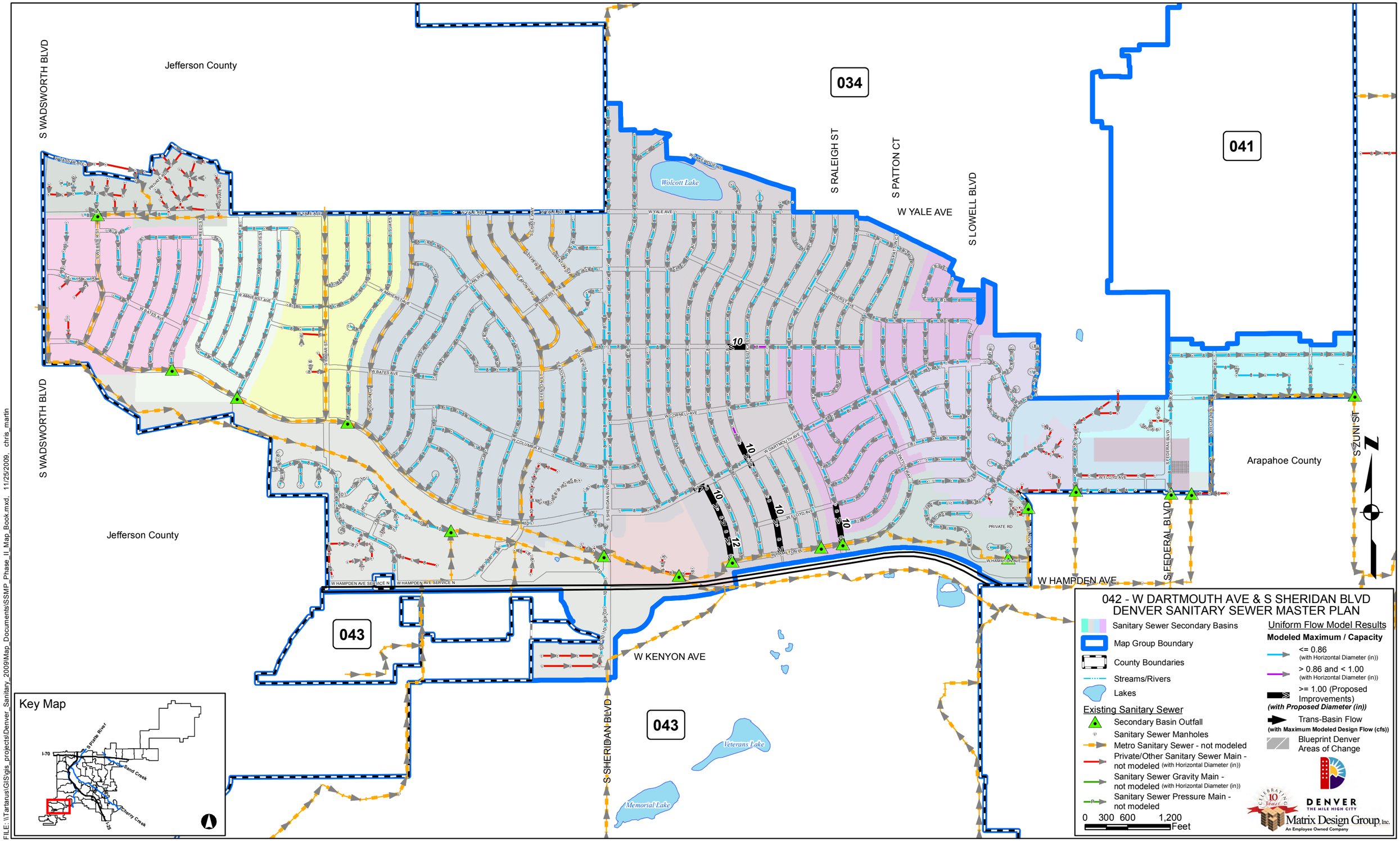
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	2,569	LF	$67	$172,123
12" DIAMETER PVC PIPE	757	LF	$71	$53,747
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	19	EA	$3,040	$57,760
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	29,506	SY-IN	$8	$236,047
WET UTILITY RELOCATE	1	EA		$37,985
DRY UTILITY RELOCATE			5%	$27,883
			SUBTOTAL	$585,545
TRAFFIC CONTROL			3%	$17,566
MOBILIZATION			10%	$58,554
ENGINEERING			15%	$87,832
MATERIALS MANAGEMENT			7%	$40,988
ADMINISTRATIVE			10%	$58,554
CONTINGENCY			25%	$146,386
	2008 ESTIMATED TOTAL COST			$995,425

Model Output Summary - Denver Owned Gravity Mains

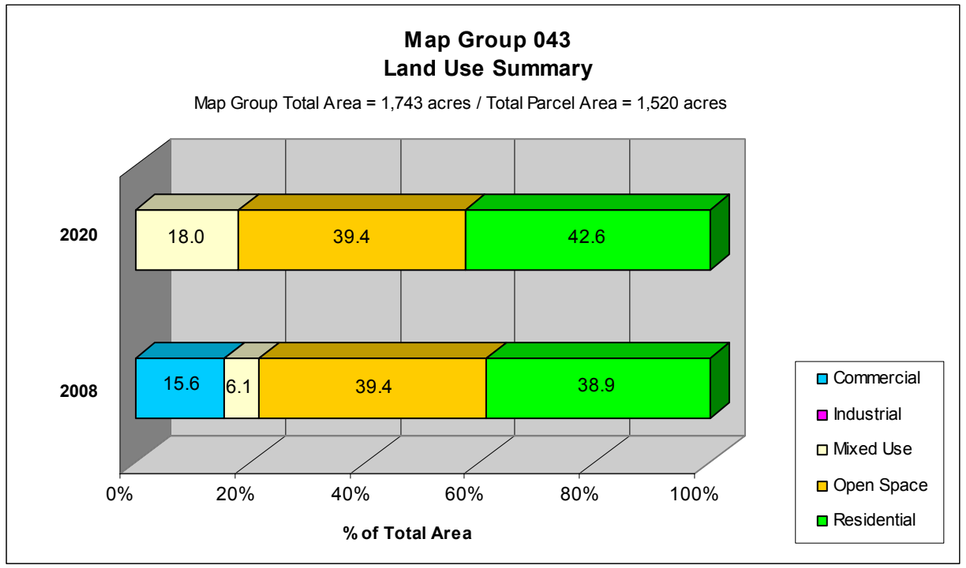
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	0	0.0
<= 0.86	172,544	97.8
> 0.86 & < 1	548	0.3
≥ 1 & < 2	3,327	1.9
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	176,419	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


042 - W DARTMOUTH AVE & S SHERIDAN BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
Key Map
Jefferson County
Arapahoe County
S WADSWORTH BLVD
S RALEIGH ST
S PATTON CT
W YALE AVE
S LOWELL BLVD
S FEDERAL BLVD
S ZUNI ST
W HAMPDEN AVE
W KENYON AVE
S SHERIDAN BLVD
Wolcott Lake
Veterans Lake
Memorial Lake
034
041
043
043
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 043 (W Kenyon Ave & S Sheridan Blvd)

Existing sanitary sewer system as of October 13, 2008



MAP GROUP 043 COST ESTIMATE

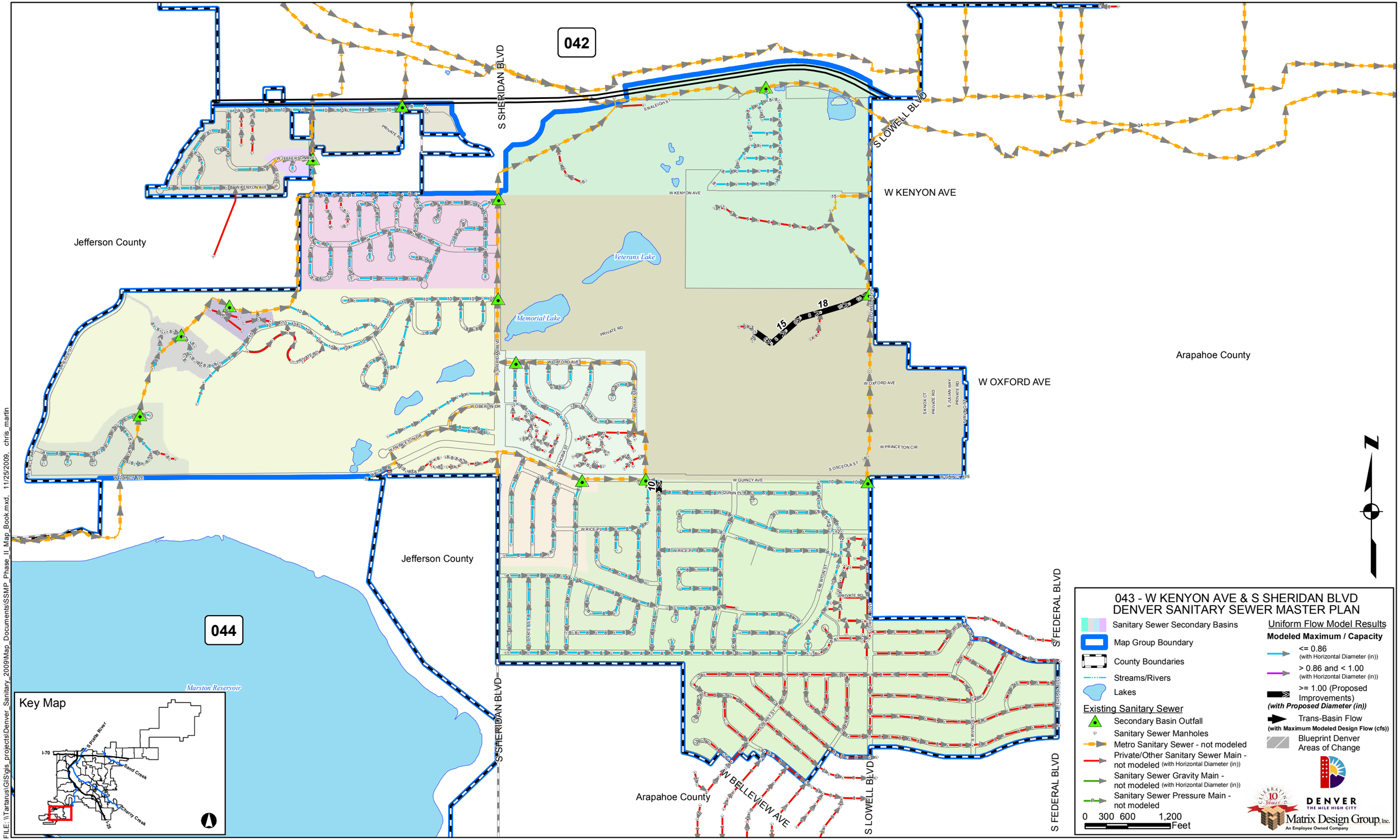
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	163	LF	$67	$10,921
15" DIAMETER PVC PIPE	835	LF	$76	$63,460
18" DIAMETER PVC PIPE	1,020	LF	$81	$82,620
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	10	EA	$3,040	$30,400
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	18,854	SY-IN	$8	$150,829
WET UTILITY RELOCATE	1	EA		$2,675
DRY UTILITY RELOCATE			5%	$17,045
			SUBTOTAL	$357,950
TRAFFIC CONTROL			3%	$10,738
MOBILIZATION			10%	$35,795
ENGINEERING			15%	$53,692
MATERIALS MANAGEMENT			7%	$25,057
ADMINISTRATIVE			10%	$35,795
CONTINGENCY			25%	$89,488
	2008 ESTIMATED TOTAL COST			$608,515

Model Output Summary - Denver Owned Gravity Mains

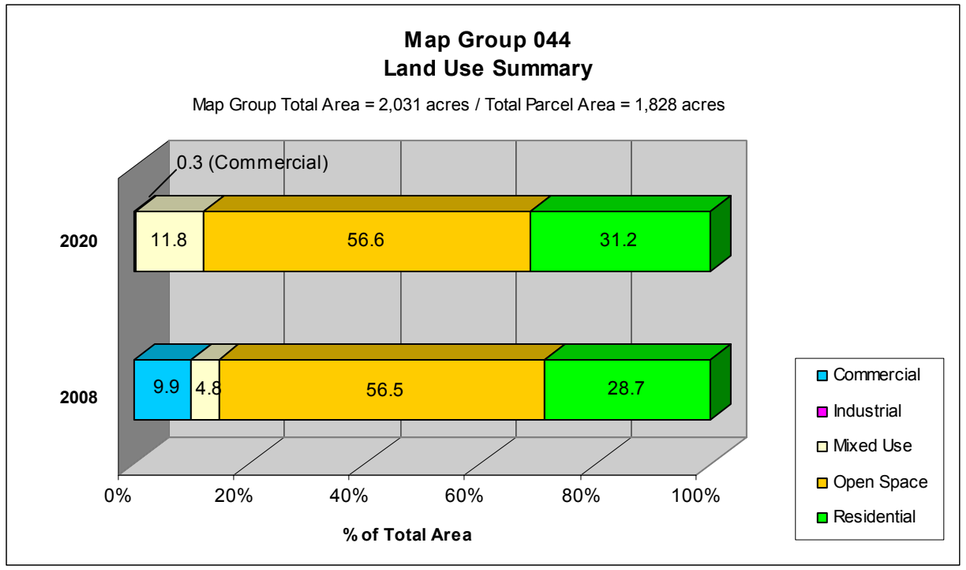
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	42	0.0
<= 0.86	94,955	97.9
> 0.86 & < 1	0	0.0
≥ 1 & < 2	884	0.9
≥ 2 & < 4	0	0.0
≥ 4	1,133	1.2
Total	97,015	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.


042
044
S SHERIDAN BLVD
S LOWELL BLVD
W KENYON AVE
W OXFORD AVE
W QUINCY AVE
S FEDERAL BLVD
W BELLEVIEW AVE
Jefferson County
Arapahoe County
Veterans Lake
Memorial Lake
Marston Reservoir
Key Map
043 - W KENYON AVE & S SHERIDAN BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group 044 (W Quincy Ave & S Wadsworth Blvd)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

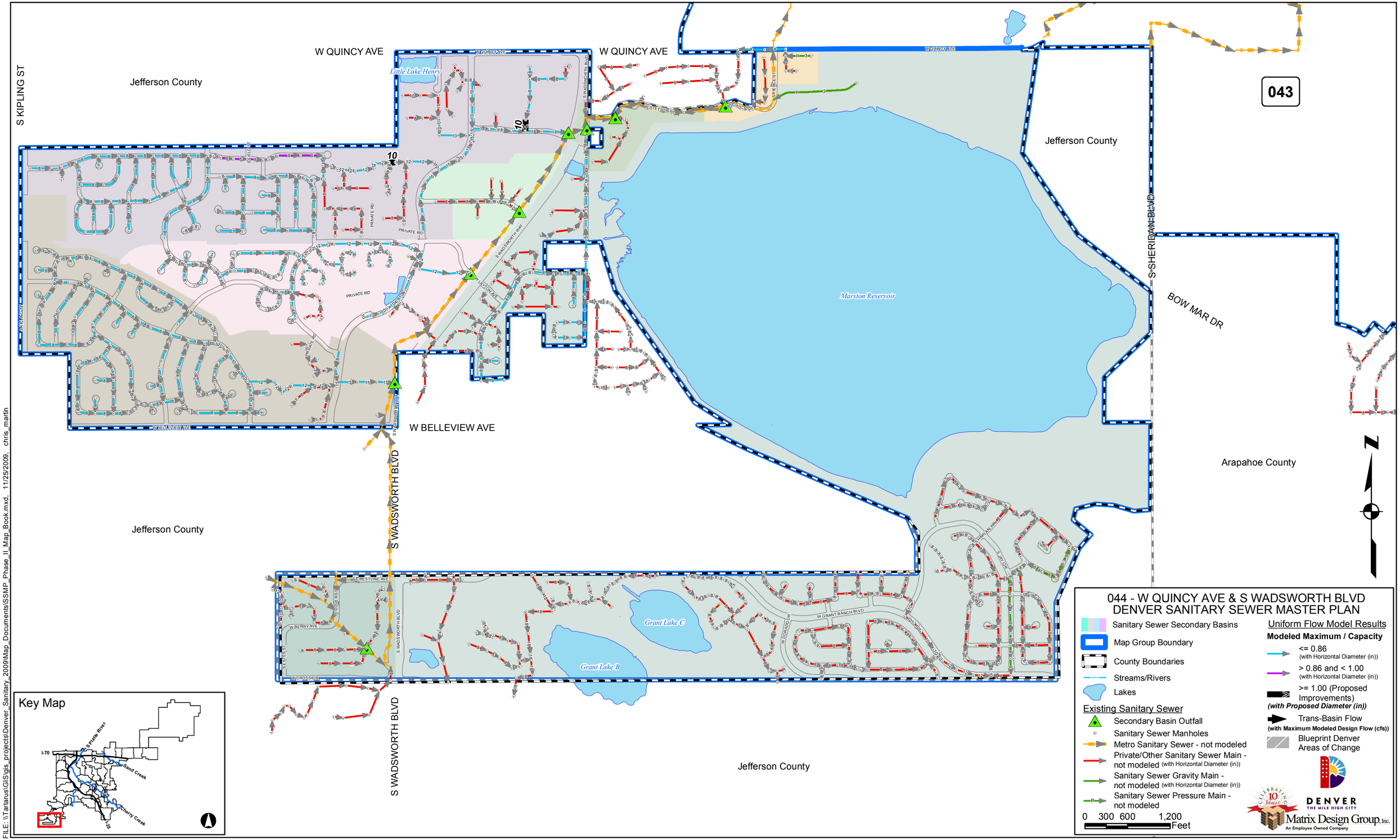
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	141	0.2
<= 0.86	75,428	97.3
> 0.86 & < 1	1,689	2.2
≥ 1 & < 2	244	0.3
≥ 2 & < 4	0	0.0
≥ 4	0	0.0
Total	77,502	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP 044 COST ESTIMATE

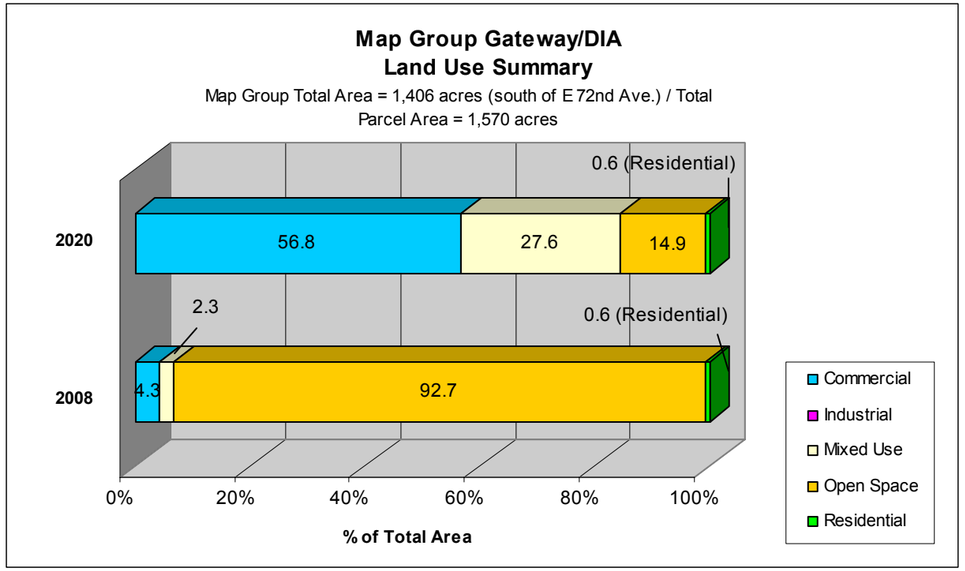
SANITARY SEWER IMPROVEMENTS

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
10" DIAMETER PVC PIPE	243	LF	$67	$16,281
4 FT. DIA. MANHOLE TYPE A CONCENTRIC CONE	4	EA	$3,040	$12,160
ASPHALT PATCH (ASSUME 9 IN. THICKNESS)	2,147	SY-IN	$8	$17,172
WET UTILITY RELOCATE	1	EA		$2,675
DRY UTILITY RELOCATE			5%	$2,414
			SUBTOTAL	$50,702
TRAFFIC CONTROL			3%	$1,521
MOBILIZATION			10%	$5,070
ENGINEERING			15%	$7,605
MATERIALS MANAGEMENT			7%	$3,549
ADMINISTRATIVE			10%	$5,070
CONTINGENCY			25%	$12,676
			2008 ESTIMATED TOTAL COST	$86,193


044 - W QUINCY AVE & S WADSWORTH BLVD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
0 300 600 1,200 Feet
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements) (with Proposed Diameter (in))
Trans-Basin Flow (with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc. An Employee Owned Company
Key Map
I-70
S Platte River
Sand Creek
Cherry Creek
I-25
W QUINCY AVE
S KIPLING ST
Jefferson County
Little Lake Henry
S WADSWORTH BLVD
W BELLEVIEW AVE
Marston Reservoir
S SHERIDAN BLVD
BOW MAR DR
Arapahoe County
043
Grant Lake C
Grant Lake B
W GRANT RANCH BLVD
W CRESTLINE AVE
W BERRY AVE
W CROSSIER
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd, 11/25/2009, chris_martin

Map Group Gateway/DIA (E 56th Ave & N Tower Rd)

Existing sanitary sewer system as of October 13, 2008



Model Output Summary - Denver Owned Gravity Mains

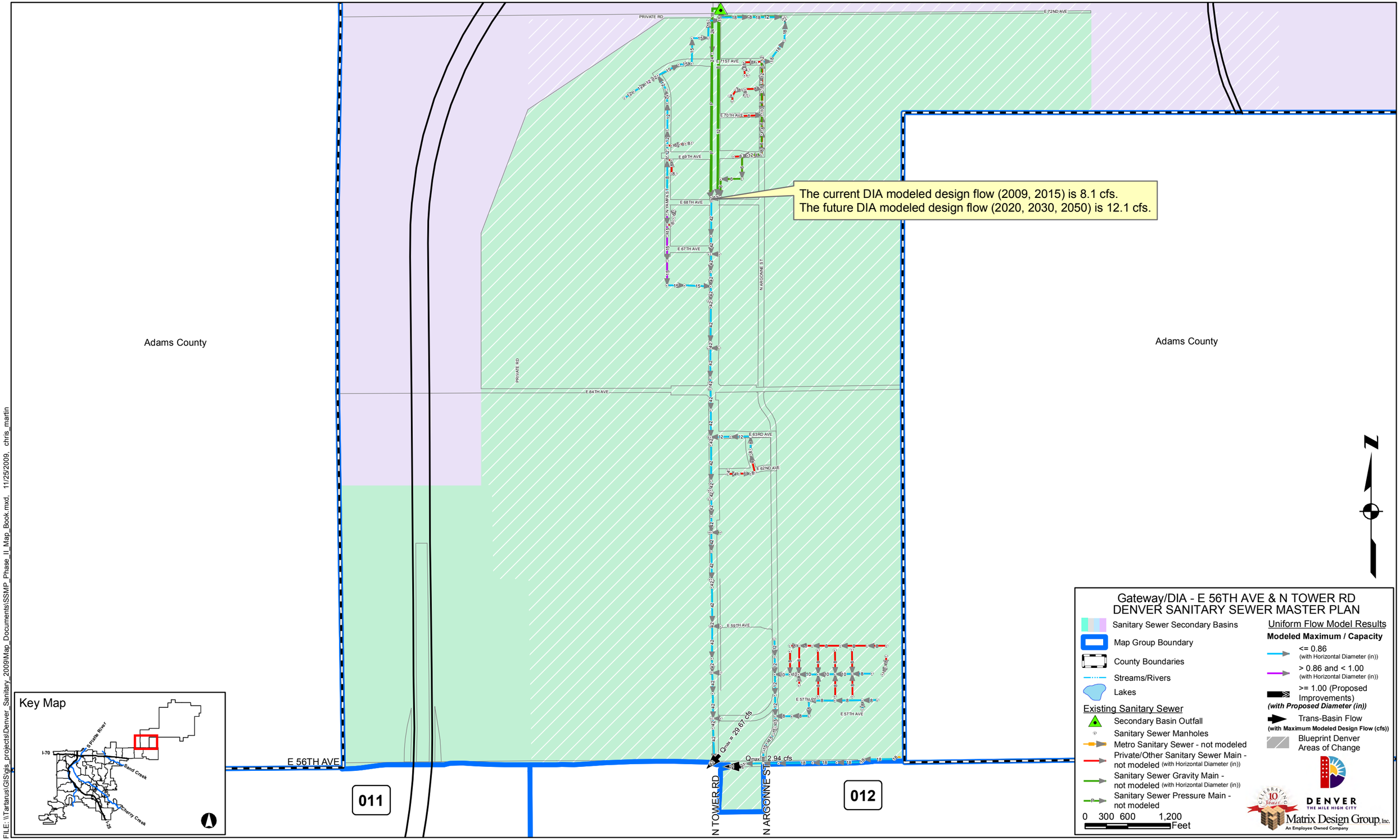
Modeled Flow / Capacity	Cumulative Length (feet)	% by Length
Not Modeled*	1,028	4.2
<= 0.86	22,305	91.3
> 0.86 & < 1	1,076	4.4
≥ 1 & < 2	0	0.0
≥ 2 & < 4	0	0.0
≥ 4	25	0.1
Total	24,434	100

*Pipes were not modeled due to missing GIS data, of physical parameters, required to calculate pipe capacity or due to insufficent GIS network connectivity.

MAP GROUP GATEWAY/DIA COST ESTIMATE

SANITARY SEWER IMPROVEMENTS

2008 ESTIMATED TOTAL COST	$0


Gateway/DIA - E 56TH AVE & N TOWER RD
DENVER SANITARY SEWER MASTER PLAN
Sanitary Sewer Secondary Basins
Map Group Boundary
County Boundaries
Streams/Rivers
Lakes
Existing Sanitary Sewer
Secondary Basin Outfall
Sanitary Sewer Manholes
Metro Sanitary Sewer - not modeled
Private/Other Sanitary Sewer Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Gravity Main - not modeled (with Horizontal Diameter (in))
Sanitary Sewer Pressure Main - not modeled
Uniform Flow Model Results
Modeled Maximum / Capacity
<= 0.86 (with Horizontal Diameter (in))
> 0.86 and < 1.00 (with Horizontal Diameter (in))
>= 1.00 (Proposed Improvements)
(with Proposed Diameter (in))
Trans-Basin Flow
(with Maximum Modeled Design Flow (cfs))
Blueprint Denver Areas of Change
0 300 600 1,200 Feet
DENVER THE MILE HIGH CITY
Matrix Design Group, Inc.
An Employee Owned Company
The current DIA modeled design flow (2009, 2015) is 8.1 cfs.
The future DIA modeled design flow (2020, 2030, 2050) is 12.1 cfs.
Adams County
Adams County
E 72ND AVE
PRIVATE RD
E 71ST AVE
E 70TH AVE
E 69TH AVE
E 68TH AVE
N YAMPA ST
E 67TH AVE
N ARGONNE ST
PRIVATE RD
E 64TH AVE
E 63RD AVE
E 62ND AVE
E 59TH AVE
E 57TH RD
E 57TH AVE
E 56TH AVE
N TOWER RD
N ARGONNE ST
Qmax = 29.67 cfs
Qmax = 2.94 cfs
011
012
Key Map
S Platte River
I-70
Sand Creek
Cherry Creek
I-25
N
FILE: \\Tartarus\GIS\gis_projects\Denver_Sanitary_2009\Map_Documents\SSMP_Phase_II_Map_Book.mxd 11/25/2009 chris_martin

This page intentionally blank